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HOW TO DO RESEARCH WORK

A MANUAL OF RESEARCH PROCEDURE PRESENTING A SIMPLE EXPLANATION OF THE PRINCIPLES UNDERLYING RESEARCH METHODS.

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PREFACE

During and since the Great War, interest in research in this country has spread, rapidly, beyond the walls of a few scattered academic chambers and the occasional government bureaus and business enterprises which were first to see the necessity of discovering new light concerning the problems that arose in connection with their immediate affairs. But this growth in research pursuits has not greatly stimulated the production of literature which serves to answer the question of how to do research work. Such literature as exists, or is being written, seldom explains in understandable terms the fundamental tool of research, method, in relation to the actual procedure of discovering and solving research problems. Most treatments are devoted either intensively to statistical methods or to the description of "psychological laws," presumed to furnish the basis of method in doing things. This book has been written, primarily, to provide the research worker with a method of procedure from the beginning to the end of a research undertaking, and, secondly, to offer suggestions concerning the mental processes involved and statistical devices that may be used in handling the data.

W. C. SCHLUTER

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HOW TO DO RESEARCH WORK

CHAPTER I

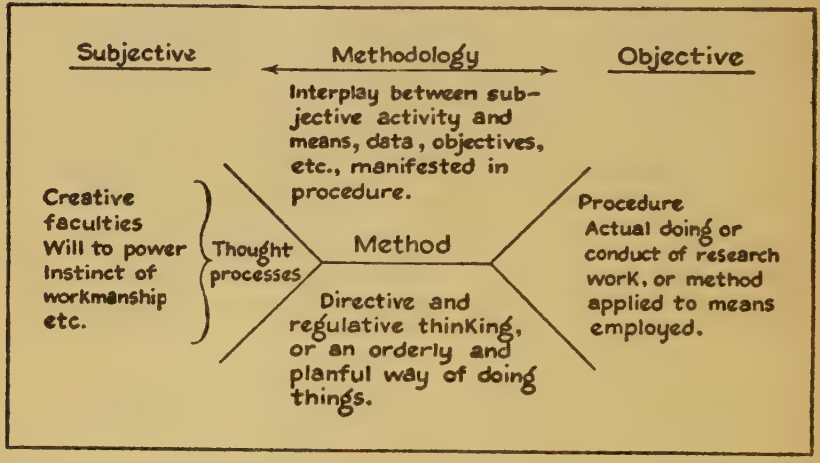
INTRODUCTION

Aim of treatment.—It is the purpose of this volume to present, in as simple a manner as possible, the philosophy and principles which underlie the pursuance of research, and to provide the researcher with a workable methodology. The author is not deluded by the idea that it is possible to formulate any rigid theory of procedure which shall be correct regardless of actual conditions in practical fields of research; but he has striven to clarify the fundamentals of all research method, with their particular application in the field of business and social economy, hoping that, even to those already familiar with research procedure, the undertaking may offer suggestions for improved methods and new viewpoints. It is to these coworkers—to the director and the teacher of research method, and to the student pursuing research work—that this little volume is addressed.

Meaning of research.—Research is the endeavor to discover, to develop, and to verify knowledge. Latent and unverified knowledge, being the objective of a quest or inquiry, must then be conceived in terms of problems. Research is therefore directed toward the discovery of problems, and consists of the methods upon which the solutions of these problems are predicated. A man may

be passively acquainted with knowledge, that is, he may know, because he has memorized facts, principles, and applications, or even unproved knowledge from books or other publications, or from experience. He may not have questioned: "How has verified knowledge come to exist?" or "How has knowledge been derived?" If such thought-provoking questions have not occurred to him, how much less is he likely to be aware of research, that is, the consciously planned endeavor to solve problems which are suggested in terms of the unknown.

The basic concept of research is method, a purely subjective activity. The objective manifestation of method is the orderly and planful employment of means (data, objectives, etc.), which is known as procedure. This concept of method may be illustrated by diagram:


Subjective
Methodology
Objective
Interplay between subjective activity and means, data, objectives, etc., manifested in procedure.
Creative faculties
Will to power
Instinct of workmanship
etc.
Thought processes
Method
Procedure
Actual doing or conduct of research work, or method applied to means employed.
Directive and regulative thinking, or an orderly and planful way of doing things.

It may be inferred from the diagram that purposeful and orderly procedure is method objectified. Behind the employment of method lie mental processes. Call them "The Creative Faculties," "The Will to Power,"

or "The Instinct of Workmanship," which do not permit of explanation, for the so-called science of psychology is still too inexact to furnish us with much light on their origin or function, and their relationship to methodology. Therefore, we must confine ourselves to a description of the manner in which such processes become manifest in orderly procedure, which is method in the employment of means. What we wish to emphasize is the constant interplay between the subjective, or mental, activity of the researcher and the means—data, objectives, and so forth—which it employs as it is objectively manifested in procedure. In the discussion, "How to Do Research Work," therefore, we shall confine ourselves to an explanation of research procedure and to a description of the subjective processes manifest in procedure in order to make clear the nature of directive and regulative thinking which is essentially method.

Universality of research method.—The field for research work is broad indeed, covering, as it does, the whole arena of human interests. There is, for example, research in law, in medicine, in chemistry, in biology, in business, in social and political economy, in literature, and so forth. In each of these fields, four types of problems are to be met: (1) the historical, (2) the experimental or "laboratory," (3) the survey or "practical," and (4) the synthetical or "philosophical." Conditions, viewpoints, bases for illustration, and so forth, must vary with each field, so that the problems to be solved in any given field might be overwhelmingly of one or another type. But the methodology in each field, specialized though it might be in detail of procedure, would, nevertheless, be substantially the same—the systematic direction of the crea-

tive faculties in the manipulation of data for the solving of problems—a constructive method of inquiry following certain recognizable principles. In order to limit the scope of this discussion sufficiently to permit of illustration and adequate explanation, we assume the point of view of, and confine ourselves to the conditions existing in, the field of business and the social sciences, remembering always that research in this limited field is the same as research in any other and in all other field or fields.

Rigid formulation of method and procedure impossible.—It would be impossible, however, to devise a standard uniform plan of procedure, for no two research undertakings could be exactly alike in detail. There is, on the one hand, a marked dissimilarity in mental endowments and creative ability among the individuals who do research work; while, on the other hand, there is what we have already mentioned, a variation in the conditions and circumstances which determine the objective nature of research problems in different fields. Thus, methodology, because of its dynamic nature, being a means, not an end, defies portrayal in terms of formula or standardization. Nevertheless, by the use of a logical scheme in the carrying out of research procedure, it seems possible to describe and explain the dynamic elements in research method in such a way that their validity and their soundness as guiding principles in the conduct of actual research in all fields may be attested by the consensus of informed opinion on research methods.

The point of view set forth above should be of service also to the directors of research, the teacher of research method, and the student pursuing research work, particularly in the field of business and social economy.

Steps in research procedure.—With these considerations in mind, the sequence of steps presented below seeks to provide a framework upon which to build research procedure, affording at the same time a practical presentation of the principles and philosophy underlying research method, and answering as well as can be done the question of methodology for the individual who desires a clear understanding of how to do research work.

1. Selecting the field, topic, or subject for research.
2. Surveying the field to apprehend the research problem.
3. Developing a bibliography.
4. Formulating or defining the problem.
5. Differentiating the elements in the problem and outlining.
6. Classifying the elements in the problem on the basis of their relation to data or evidence (direct or indirect).
7. Determining the data or evidence required on the basis of the elements in the problem.
8. Ascertaining the availability of the data required.
9. Testing the solvability of the problem.
10. Collecting the data and information.
11. Systematizing and arranging the data preparatory to their analysis.
12. Analyzing and interpreting the data and evidence.
13. Arranging the data for presentation.
14. Selecting and using citations, references, and footnotes.
15. Developing the form and style of the research exposition.

Induction versus deduction.—Before proceeding with the analysis and interpretation of these steps, it seems necessary to clarify briefly some current notions concerning inductive and deductive processes of thinking as employed in research which are seemingly contradictory. Abstractly defined, induction is a process which begins with observed facts or collected data that suggest inferences, leading to the framing of ideas, to the association of related ideas in conceptions, and finally the defining of these conceptions, the drawing from them conclusions—abstractions and generalizations. Deduction, on the other hand, is the reverse process, beginning as it does with hypotheses, that is, tentative conclusions or generalizations, and working back to possible supporting data for tests or verifications of the originally posited idea. Once clearly understood these two methods or processes of thinking employed in research should never be confused, nor held as inconsistent with each other. Either mode of inquiry is justifiable and both are often applicable. Certain fields of research may require greater emphasis on one than on the other. In the general run of research problems, however, the two go hand in hand. No matter how refined a researcher's processes of induction, he will invariably find that he has to some extent anticipated or forecasted meanings and ideas. On the other hand, close scrutiny of his mental processes will convince the deductive thinker that the data he manipulates for proof of already assumed hypotheses may suggest meanings which lead to entirely new ideas, or which lead him to modify or complete those hypotheses.

Suppose, for illustration, that a research problem has to do with the relation of retail prices to wage rates

over a certain period of time. What that relation is is unknown, until data on retail prices and wage rates have been collected. After these have been gathered, their analysis and interpretation will suggest meanings or inferences leading to the discovery of the relation, that is, to the conclusion. This seems like an "inductive" approach; but, actually, both deductive and inductive processes went hand in hand in the task of discovering the relation, for the supposition that a relationship between prices and wage rates existed may have been the result of deduction to start with, and the inferences or evidence drawn from the data may have been anticipated or forecasted at various times in the research procedure. Now, let us assume that the management of a business enterprise "has an idea," a policy, which, if put into effect, might yield profitable returns. The origin of this "idea" may have been in specific or general observations, in experience, in day-dreams, reveries, reflection, or in whatever thought process can give rise to an idea. But before such an "idea" or policy can be put into effect, the management may find it necessary to determine what conditions exist favorable to the carrying out of the policy or to create those conditions. Here we have first the "idea" followed by the research work which determines whether the conditions are such that the "idea" can be carried out. This appears to be a "deductive" process. Actually, however, the two processes have gone hand in hand in the details of procedure and method, for the data which he collects and analyzes in support of his theory may suggest in themselves certain inferences or ideas which will alter or add to his original policy. Time and space forbid a more extended discussion at this point. We have striven

to make clear only the essential nature of these processes, and a more detailed reference will be made later on.

Importance of bibliography.—In order to apprise the researcher of such literature as is immediately relevant to various aspects of research methods, means employed, and procedure, a brief list of references is appended to each of the individual chapters. The study of these materials should lead to an improved background and a broader viewpoint, invaluable in conducting research.

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Chapter II

STEP I—SELECTING THE TOPIC, SUBJECT, OR FIELD FOR RESEARCH

Difference between field and problems.—Research begins with the attempt to apprehend a problem, a difficulty, or the outline of a question to be answered. These lie within the limits circumscribed by the topic, subject, or research field. But there should be a clear recognition and understanding of the difference between the research problem and the topic, subject, or field within which it lies or to which it pertains. The field of interest in which an investigation or inquiry is to be conducted must not be confused with the problem itself, or the definite objective to be worked toward as determined by an adequate definition of the research problem. And the researcher must be warned that there is still considerable time and effort required after the field, topic, or subject for research has been selected, in determining definitely and clearly the exact scope, object, or purpose of the intended investigation. At this point we are approaching the step of formulating or defining the problem, while it is necessary first to explain the factors to be considered in making a choice of research topics or subjects.

General factors in selection.—Much time and effort are often consumed in selecting topics for research. This is especially true when those undertaking such work are inexperienced in the pursuit of research, or

are lacking in knowledge of, or acquaintanceship with, research fields. It must not be assumed, however, that the selection of a field for research is necessarily an easy task. On the contrary, it requires considerable thought and study to make sure that the choice is based on an adequate consideration as to whether the field selected affords questions of interest and utility. However, the researcher may not be in a position to make an unrestricted choice because of circumstances.

Point of view of research worker.—The basis for selection must depend first upon the position of the researcher. He may be an employee of a business concern, a government, or a public bureau, or of any other organization devoting itself to investigations. In such a case the field will very likely be designated for him, with the preliminary work involved in making the selection already carried through by others. If he be a student, proper pedagogy would forego the exercise of paternalism in making the choice, leaving it to his own responsibility, with such supervision of the selections as may seem desirable at times. But it may be that academic institutions or departments may desire to have the students pursue selected fields for research. The field of choice may also be further limited for the student by the requirements of "majoring" or "specializing" in particular departments. Often these restrictions are necessary, even desirable, since the research student after graduation is frequently confronted with similar restrictions in his choice by business concerns or by any of the other agencies previously referred to with which he may establish connections. Even so, it might still be the research student's or employee's lot occasionally to select topics or subjects within specified research fields. As a contrast to these restrictions in

choice stands the free lance researcher. But here again freedom of choice may be qualified by two factors: (1) the requirement for specialization, and (2) the necessity of earning a livelihood. In other words, no research student can be a Jack-of-all-trades, and, furthermore, the gods may not have provided him too generously with worldly goods.

Limitations of freedom of choice.—From the standpoint of the research worker, then, freedom in choice is limited by the exigencies of his position or affiliations, and personal interest, far from being the sole guide, must in reality be compromised with the demands of actual circumstances. Yet, at all times, must the mainspring interest in the field be guarded, even though his ability and the utility of the results be judged by others. In so far as the researcher possesses freedom in selecting a topic for investigation, the advantage that may be taken of this freedom invariably depends upon his type; there are those who are aggressive, alert, imaginative, and quick to see fields which are fertile for investigation; and there are those who are passive and unimaginative and forever content to work out the problems suggested by others.

Guides to making a choice.—Such guiding principles as might serve in selecting or choosing topics, subjects, or fields might profitably be suggested in the form of queries which the research student should ask himself:

1. Does the field appeal to my interest?
   a. Is the interest purely intellectual?
   b. Is the interest present because of reward—pecuniary returns, possibility of advancement in position, increased authority, and so forth?

2. Are the results that may be obtained of practical or utilitarian significance?
   a. May they be of use in business?
   b. May they be useful to society, to government, or to others?
3. Does the field present gaps in verified knowledge which need to be filled?
4. Does the field require reworking?
5. Does the field permit extension of inquiry beyond the present limits of verified knowledge?
6. Is the field pivotal or strategical from the standpoint of the immediate purposes which the possible results of investigation are to serve?

Final determining factors.—The background of education and experience possessed by the individual making a choice of research fields is always an important factor to be considered in connection with the judgment called for in applying the above principles of selection. A completely rational choice is very often impossible, unless the pressure of immediate circumstances points directly to the field in which the problem lies. This may occur quite often in the field of business. Again, flitting ideas, products of creative thought, reveries, or day-dreams may lead to intuitive selection. The domination of practical considerations may overshadow personal interest. Irrational choices are often made when fields are passively accepted, or when they are forced upon the researcher by authority, or when the choice is made by an unenergetic and unimaginative mind.

Interest must be assured.—In the practical world of to-day, in which most people engaged in research must also seek a livelihood, there must be a combination

of proper consideration for the practical significance of the results to be achieved, with as much of the element of personal interest as is possible. While interest in research may be acquired if it is not inherent, without its presence, the effort to do research work will become difficult to sustain, for the spirit behind research rests chiefly on interest to stimulate the imagination or the creative faculties in achieving the final results.

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Chapter III

STEP II—SURVEYING THE FIELD TO APPREHEND THE RESEARCH PROBLEM

General features of a survey.—What criteria should be employed in choosing a field for research depends largely upon the background of the individual who attempts the choice. His ability to see in a field possibilities for research problems depends naturally on the degree of his acquaintance with the field itself. Two pertinent questions suggest themselves in this connection: (1) How is one to acquire a sufficient background—how much time and effort is one to expend in gaining an insight into the field? And this point settled (2) What are the underlying purposes in surveying the field for problems? The answers to these questions will embody in large measure the features of a survey of a field for investigation.

How knowledge of field may be obtained.—Knowledge of a subject for research is acquired either through actual experience, observation, or promiscuous reading, or through definite and purposive study. The depth of understanding to be gained by the first three means can be gauged, on the one hand, by the scope of the experience, observation, and reading; on the other, by the mental capacity of the research student to accumulate a store of empirical knowledge through keen and intelligent observation and his ability to assimilate the

knowledge so obtained by reflective thinking. It must be remembered, however, that an intelligent background cannot be built up by mere memorization, or by a haphazard retention of impressions. If the student has acquired an understanding of the chosen field through an attitude of inquiry, critical study, and thoughtful reflection, he should be well equipped to make a detailed examination of the field and should encounter no great difficulty in recognizing the specific possibilities for research that it may contain.

Requirements for actual study.—To the extent that actual experience, observations, and general reading have not led to an adequate familiarization of the researcher with the field or subject, to that extent must he inaugurate a definite plan of study to make good the deficiency, for, without a thorough understanding of the field, intelligent and accurate survey are out of the question.

Discovering the literature.—His task is then twofold: (1) It becomes necessary to build up a bibliography of the literature covering the field, or (in case there is an absence or paucity of literature) a body of knowledge acquired by interview with those who have experience and information on the subject. Should the literature dealing with the subject be voluminous, then the need for selective reading is urgent. (2) The information obtained from the bibliography or from the interviews should be thoroughly studied; that is, the information must not be left in its objective state (in the form of bibliography or notes), but must be mentally digested. In this connection it is well to emphasize that, whether the information is obtained by reading or by interview, the taking of notes should constantly record that information, in order to preserve it

in accurate detail, for memory cannot be relied upon sufficiently to insure a view of the field from every possible angle, and in complete detail.

Selecting important literature.—In the event that the amount of literature on the subject is large, the necessity of building up a selective bibliography presents a knotty question to the initiate. He will ask the question, "On what basis am I going to select the necessary literature?" And the answer depends chiefly upon his own qualifications for research. Obviously, it is necessary to read and to study the most complete and the most authoritative literature, in order to obtain a well-rounded view of the subject. There are many simple devices which facilitate the search for the titles of such literature and the names of authors. A few contacts with persons acquainted with the field, or a profitable half hour with the silent card catalogues and other sources of the library, will soon reveal them.

Choosing and making personal contacts with those informed.—Plainly, it is considerably easier to select the best from a quantity of existing literature than it is to become acquainted with a subject about which little or nothing has been written. Reference has already been made to the necessity of relying on interviews and personal contacts in such cases. But it must be emphasized that, before an appeal is made to others, the researcher should diligently search his own mind for ideas and information relating to the field of intended investigation gained from experience and observation and should critically reflect upon these. He is then in a position to approach others with assurance that they will recognize and respect his intelligent attitude. This done, he may address such informed persons by personal visitation or correspondence. Personal interview

is by far the preferable means, if it is at all possible. By such contacts with individuals judiciously selected, according to their position, point of view, and intelligence, or according to other criteria regarding their qualifications to give information, the research worker can often cover adequately whatever there is to be known about the subject.

Purpose of preliminary survey.—The effort to obtain an adequate understanding of the field selected for research has a definite purpose. Succinctly stated, this purpose is to apprehend or to discover a research problem. The location within the field of research problems will depend upon conditions in that field with respect to inquiry already conducted there. Whatever possibilities for the existence of problems there are will depend upon: (1) whether there is any gap in the mass of verified knowledge developed in the field selected; (2) whether an extension of inquiry beyond the verified knowledge and into the yet unknown is possible; and (3) whether there are obsolete or untenable sections of formerly developed knowledge which now require reworking. These three considerations then constitute three points of view from which we may survey the field to locate possible problems.

Nature of a well-planned survey.—Common sense will indicate that this preliminary survey is required before a workable formulation of the problem is possible. In addition to these practicable considerations, there should be clearly kept in mind the reasons for which the field itself was selected as an aid in focusing the attention on the objectives to be achieved by the preliminary survey. The vital element of the researcher's interest in the field should also be enlisted, in order that it may be illuminated from every angle

for critical examination. One might compare the procedure of surveying the field with the climbing of a high tower for the purpose of envisaging a city, thus beholding it as a whole, observing its various sections and their ramifications, noting its extent and its limits, its developed and its undeveloped portions and its obsolete parts, and, by such survey, discovering the places where additions, reconstructions, and new constructions would be timely and profitable. Unfortunately, such favorable positions for observation are not always possible. It is often necessary for the researcher to explore his field on hands and knees, groping through the underbrush, pushing his way, like the pioneers, through confusing and unfamiliar forests. To the hardy are reserved the thrills.

Guiding principles in conducting survey.—Whatever the aspects of the particular procedure required in surveying the field to apprehend the problem or problems, certain guiding principles may be of great aid to the research worker in carrying through this important preliminary step:

1. Careful introspection, in order to take a mental inventory of the knowledge of the field already possessed.
2. Evaluation or critical examination of this accumulated knowledge, so far as possible, in the light of the nature of the sources from which it was derived.
3. Discovery of what is known and what is yet to be found out about the subject.
4. Preparation of a bibliography.
5. Mobilization of all knowledge already possessed before approaching others.

6. Discussion of the subject or field with others who have reason to be informed, if this is necessary or desirable.

7. Harnessing of personal interest in the subject to the knowledge obtained about the subject, so that the field may be adequately covered from all angles.

8. Taking careful note of those aspects of the field which furnish possibilities for research problems.

9. Reflection upon, and mental digestion of, all information gained in relation to the field, to make the subject vital to the researcher.

Bibliography and interviews.—The research worker has been asked to rely for information partly on a bibliography, and partly on appeal to others. Although the preparation of a bibliography may have to be completed, it is of sufficient importance to deserve separate treatment, which shall engage us under Step III. In regard to the principles that should govern the research student in conducting interviews and correspondence, in the procedure under the present step, he is referred to Step X, where these are discussed.

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Chapter IV

STEP III—DEVELOPING A BIBLIOGRAPHY

Summary of objectives.—Discussion of the previous step should have made exceedingly plain that, in order to survey a field of research, sufficient knowledge of the field must be obtained, and that the purpose of a complete survey from various angles is the apprehending or the discovering of the setting or locus of the research problem or problems. It was found that a completed survey should reveal one or more of the following conditions: (1) the existence of gaps or discontinuity, indicating incompleted development of verified knowledge within the field; (2) evidences of the existence of obsolete or untenable knowledge within the field, requiring fresh study or reworking; (3) indications that there are possibilities of extending the inquiry beyond the limits to which adequate investigation in that field has so far progressed, and, finally, a condition which was not previously suggested, but which should be stated; (4) intimations that special aspects of a field that have been developed by investigations may require correlation or coördination, or that the data and conclusions built up by these special researches may serve as a basis for broader abstractions and generalizations.[1] A careful preliminary survey should throw all of these conditions into prominence.

[1] This type of research problem should be left, as a rule, to individuals who are well matured and who possess a background acquired by long study and research in a given field.

Purposes of a bibliography.—The development of a bibliography of the literature relating to the field chosen for research plays an important part in providing a background for a thorough survey. In doing so, it serves a twofold purpose: (1) obtaining knowledge of the field; and (2) discovering the extent to which the field has already been investigated with satisfactory or unsatisfactory results. The first aim of the bibliography affords a thorough understanding of the subject, while the latter leads to insight into the possibilities of further research with respect to it, and into the exact aspect of the subject which suggests problems.

Procedure in developing a bibliography.—The actual work of developing a bibliography requires a technique and a point of view, and, although simple in many respects, presents an obstacle of considerable weight to the novice. The steps involved in a proper procedure are presented below in order:

1. Obtain a supply of index cards for the purpose of recording the references as they are found and traced —the full name of the author, the title of the book, or, if an article, the title of the article, the volume, the date of issue, and the page of the periodical in which it appears. The index card should also bear the name of the publishers of the book, pamphlet, and so forth, and their addresses. They should also be used for such notes as the researcher may see fit to make after the literature has been traced and while it is being perused. This enables the investigator, later, to separate, with accuracy, the good from the poor literature, instead of according to a mere memory judgment. He has a basis for sifting his materials, and thereby saves himself much time and effort. These cards should be filed alphabeti-

cally either according to the name of the author, or according to subject matter. A joint use of both systems is recommended.

2. Armed with a supply of index cards, the research worker may proceed to find the literature. He will naturally ask: "Where shall one go?" "Where are the references?" First, there is the library. In libraries may be found the sources containing references and the material referred to or the references and only a part of the material. The library sources of references are their card catalogues and the various published guides to periodical literature and to books. Substantially the same procedure may be followed in referring either to the card catalogue or to the various guides, for all references are invariably given under the name of (1) the author, the agency, or organization; (2) the title of the book or publication; and (3) the subject. The latter permits of a variety of classifications of the materials, and the researcher should, therefore, thoroughly consider the various subjects under which particular matter may be classed or indexed. The sources to which immediate recourse should be had are (1) card catalogues, (2) periodical indexes, (3) bibliographies, and (4) reference books—books listing sources. Some of the most important publications that fall within these classifications are:

a. Card catalogue of the library.
b. Cumulative Book Index—U. S. Catalogue.
c. Publisher's Trade List Annual.
d. Industrial Arts Index.
e. Reader's Guide (Poole's Index before 1906).
f. Reader's Guide Supplement.
g. International Periodical Index.

h. Annual Magazine Subject Index.

i. Agricultural Index.

j. Public Affairs Information Service.

k. Engineering Index.

l. Library of Congress—Division of Bibliography References on Various Subjects.

m. Book Review Digest.

n. New York Times Index.

o. Kroeger's "Guide to the Study and Use of Reference Books."

3. In order that the investigator may obtain all the literature in a subject up to the last minute, he should peruse many sources containing current references, for considerable time may have elapsed following the most recent additions to a body of knowledge, before references appear in such organized and published forms as previously referred to. For the purpose of insuring the up-to-dateness of one's information, such sources as the following are of great aid:

a. Table of contents and indexes of current periodicals, newspapers, and journals.

b. Book lists and advertising literature issued by publishing houses.

c. Periodicals making a practice of giving lists of latest publications. To illustrate, the *American Economic Review* furnishes quarterly a complete abstract of books, reports, and articles in periodicals pertaining to the field of social science and to business. Similar reviews often appear in various other specialized periodicals.

4. After the bibliography of references has been compiled from these various sources and the references have been carefully recorded on the index cards, the

task of surveying the literature can begin. It is often desirable for the novice in a field actually to obtain and peruse all the literature accessible. At the same time, literature that seems authoritative and complete may actually be read in order to facilitate the further selection of important material from the references, for some may require only a mere scanning of the contents. Locating the books, periodicals, or other references is often a considerable burden. What literature is available in the libraries accessible to him may be discovered from their card catalogues and, when found, the library number should be placed on the index card. However, not all literature may be available in the accessible libraries. In case such literature is contained in periodicals, the Union List of Serials may be of great service. This publication lists the periodicals subscribed for by about 200 coöperating libraries in the United States and Canada, the period during which they were subscribed for, and the issues which are retained in bound form. It is the clearing house idea applied to periodicals to be found in these coöperating libraries. The membership in this Union is constantly increasing. Should the inaccessible literature be in the form of a book, a pamphlet, a monograph, or other publication falling outside the class of periodicals, then it may be secured from the publishers whose names and addresses were noted on the index card, as previously suggested. Finally, if the research worker meets obstacles which he cannot overcome in tracing references, the services of libraries are always at his disposal.

Results to be achieved.—The directions outlined should have brought the research worker in contact with the literature covering the chosen field of research. If the bulk of the literature is relatively small, the

selection of the better material is not such a burden. If, on the other hand, the literature is voluminous, it becomes necessary to do selective reading. It must be emphasized that any survey of literature should carefully recognize the two following aims: (1) to eliminate the risk of duplicating research work already done by a perusal of the literature in its entirety; (2) to obtain a thorough understanding of the subject in selecting and reading the most complete and authentic literature. In reading and studying such literature as selected, notes of the suggestions received and of the thoughts of others worth recording should be made freely. These notes will be of service in the further study of the research problem selected and in the task of orientating the completed research in the field by means of references and citations and, in particular, with reference to other work on similar problems already done.

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Chapter V

STEP IV—FORMULATING OR DEFINING THE PROBLEM

Meaning of "formulating" and "defining."—The results to be achieved by the preliminary survey, and by its attending tasks, were clearly set down in the consideration of Step III. These should have led the researcher to a clear recognition of the general outlines and setting or locus of any problem within the field of research. The investigator has now reached the point in his procedure where a specific research problem must be formulated or defined. Now, this problem, so far rather vaguely apprehended and recognized only in its broad outlines, must be formulated or defined in a clear-cut statement. To formulate means "to express in, or as in, a formula," or "to state definitely and clearly." Instead of formulating the problem, some prefer to state the problem in the form of a question. This method may not be sufficiently elastic, however, to permit of a complete and an inclusive presentation of the problem. It might result in clearer and more emphatic expression were we to express the problem in a definition instead of formulating it or putting it in the form of a question. Logicians define the word "definition" as a statement, naming the genus and differentia of the thing or concept defined. Applying this meaning to the definition of a research problem, we find the term "class" or "genus" represented by the subject, topic, or

field of research, while the specific problem discovered according to the principles laid down in Chapter III becomes one of the differentia. Defining the research problem then resolves itself into the mental function of separating or differentiating the specific problem from other problems in the field of interest. Whether he resort to accurate formulation or to true definition of the research problem, the investigator makes, in brief, a clear statement of the objectives which he hopes to attain through his inquiry.

Conditional nature of the original formulation.— If the procedure outlined in the foregoing three steps has been conscientiously followed as the basis for recognizing the problem for research, no great difficulty should be encountered in accurately stating the specific objective of the investigation. This does not mean that any formulation or definition of the problem must remain permanent throughout the investigation. Such a formulation or definition can be tentative only at this stage of research procedure, for, during the progressive stages of the procedure, the necessity or desirability of subsequent reformulations may become evident. The first formulation should indeed be a clear and definite statement of objectives, in order that it may serve as a working basis; but to regard it as the final statement of the problem would be a folly, since it would lead to the slavish acceptance of an objective toward which all subsequent steps might be enforcedly directed, regardless of facts and realities which might be met along the way. Contrary to such a rigid predetermination, constant vigilance should be exercised throughout the successive steps of procedure to apprehend conditions which make a reformulation or redefinition of the original statement not only necessary, but at times desirable.

Continuous awareness on the part of the researcher of the necessity and desirability of reformulating or redefining the original statement in order to bring it in line with subsequent developments as brought about by research is a cardinal principle which must be emphasized.

Principles to be observed in the formulation.—In the preliminary formulation or definition of a research problem there are many pitfalls. In order to render a clear and definite statement of the problem which will throw into clear relief the objectives of the research endeavor, certain factors should be taken into consideration.

1. Avoid the mere posing of a problem which may have no direct relation to the actual conditions discovered in the preliminary survey of the field. To prevent such a mistake the reasons for selecting the field or topic should be revaluated, the results of the survey should be carefully reviewed in order to obtain a clear recognition of the gaps in the field, of the contiguous areas beyond the present limits which may be fertile for investigation, and of the obsolescent phases of the developed knowledge concerning the field. The formulation or definition should be regarded as stating objectives which, if attained, will complete, supplement, or add to the existing verified knowledge in the field, or replace some aspects of that formerly recognized as valid. The researcher must keep in mind that the basis for research is in the real world, and that the laboratory is in real markets, real banks, real factories, real government, real families, and so forth.

2. Give due consideration to the timeliness and importance of the problem to be formulated. The re-

search worker may encounter several or any number of problems in the field surveyed. The question becomes, "Which shall I choose?" Judgment must be exercised in order to determine the relation of the problem to the field and to other problems in the field, and careful consideration should be used for the position, the point of view, and the interests of the researcher. Practical considerations, other things being equal, might at times overshadow cultural or educational interests in the selection and statement of the problem. Time and means at the disposal of the research worker may determine the choice, or may restrict the formulation and narrow the objectives. Mental qualifications of the researcher may to some extent determine whether the statement of the problem is to be complex or simple. Pressure of the immediate necessity of an investigation, moreover, may color the nature of the problem and its definition. These are a few of the factors that must influence the decision as to the importance of the problem to be chosen.

In the matter of choice, timeliness also enters. Both from the standpoint of the relation of several problems in a field, and from that of the practical necessity of settling one difficulty before another can be approached, timeliness has its bearing. But actually these points of view may be combined, for they are influenced by similar principles. So far as possible, all problems should be selected and formulated in such order that their solutions will yield a logical and sequential development of the field. In newly opened fields, or in fields still in an inchoate condition, this rule may not be entirely applicable. The importance of the principle of timely formulation is suggested by many business or governmental problems. For example, if a business concern under-

took to install a budgetary system, it must first conduct studies of the nature of its organization, then of the internal data, accounting records, or systems, then of its markets, and so forth. If a legislative committee should attempt to investigate the effect of tariff laws, it must first find out what rates were levied on particular commodity imports, then it can proceed to a study of relative price trends, then perhaps inquire into the level of domestic production costs, and so forth. These illustrations ought to make clear to the research worker what is to be understood by the timeliness of the selection and formulation of a problem.

3. Never formulate a problem in such a way as to indicate that the aim is to prove something. Investigations setting out to prove something are not research endeavors. Voluminous publications pose currently as products of research, which defame the term "research." Such publications might well be called propaganda literature.

4. Formulate or define the problem so as to convey its meaning clearly in terms of the unknown or of the objectives to be achieved. The statement should suggest a single interpretation. The object of the inquiry —the idea of what is to be done—should be expressed "in a nutshell." An indefinite and confusing statement reveals that the research worker is not clear in his own mind as to what the research objectives signify. A confusing, complex, or seemingly distorted statement may be the result of the many-sided nature of the problem, which gives the effect of multiple problems of equal or differing weights. If the nature of the problem is complex, the statement should make plain the main objectives, and suggest the subsidiary or secondary objectives apart from these. If, however, the problem seems com-

plex, but, upon further analysis, it is found to embrace in its formulation several problems of comparatively equal importance, then the multiple nature of the inquiry or objectives should be stated separately and their separate characteristics clearly delineated.

5. Do not attempt the formulation or definition by the trial and error method alone, in order to derive a workable statement of the objectives. Serious and conscientious thought and reflection should be given to the basis of the problem, as apprehended in the study performed during the survey, before formulations are attempted. A nicely worded statement may fail to link the objectives to the actual conditions in the field which suggested the problem, and may fail to produce, therefore, a workable basis of operation.

To conclude, repeated efforts to arrive at a proper statement of the problem according to the guiding principles just laid down should bring forth a tentative but, nevertheless, a clear and definite idea of the problem stated in terms of objectives—unknowns—to be achieved by the research. "Exactly, what am I going to do?" has been answered. The point of view of the research worker has by this time shifted from the merely inchoate to the coherent, complete, and definite. A workable formula has been developed, a proper perspective has been formed, and the setting or placing of the problem within the field of research has been carefully accomplished with reference to the rest of the field. The formulation or definition embodies the exact purpose of the research endeavor, and thereby definitely motivates the research worker, harmonizing and controlling his research activities.

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Chapter VI

STEP V—DIFFERENTIATING AND OUTLINING THE ELEMENTS IN THE PROBLEM

Nature of differentiating and outlining.—Naturally, after the objectives of the research have been succinctly stated in the formulation or definition of the problem, the elements, or the constituent parts, must be differentiated. In other words, it must be broken up into its separate parts. This requires that the problem as formulated be thoroughly analyzed, in order to discern the various and separate elements of which it is composed. This process completed, the elements must be differentiated. To differentiate means "to mark by a specific difference," namely, to separate by discerning differences. This phase of the procedure calls for considerable intensive analysis of the problem and thorough-going reflective thinking. The second phase of the procedure in this step is concerned with outlining the elements. This is a process of integration. To integrate is to form into one whole, or to form a whole from constituent parts. The process of integrating or outlining, then, is the reassembling of the separated or differentiated elements into a logical relation to form a whole. The outline should present the elements in a sequential order upon which the development of the problem or the steps in the attainment of the objectives may be predicated.

Rigid plan not possible.—No absolute form or scheme can be devised by which every problem in research may be analyzed for the purpose of apprehending the elements of which it consists, differentiating these elements and outlining or logically recombining them into a logical whole. But certain guiding principles can be derived which should aid the research worker in carrying through this step in procedure. Although there are three processes involved—analyzing the problem, differentiating the elements, and recombining them, or outlining—they are so closely interrelated as to make it unprofitable to consider them separately.

Suggestive scheme of procedure.—The following scheme is suggested as an aid to the researcher in visualizing the general nature of this step in procedure:

I. Formulation or definition of the problem.
   1. Amplification of the purposes or objectives of the inquiry.
      a. Subsidiary or secondary purposes or objectives, if any.
   2. First element in the problem of initial and primary importance.
      a. Breaking up this element into its constituent parts.
         (1) Further separation of subsidiary elements, until simple and pure elements are obtained as nearly as possible.
   3. Second element following logically in the wake of the development of the first element and its component parts.
      a. Breaking up this element into its constituent parts.

(1) Further separation of subsidiary elements, until simple and pure elements are obtained as nearly as possible.

4. Similar considerations by which the logical position of the second element was determined.

And so forth, ad infinitum.

"*n*"—Correlation and coördination of all elements into a final combination, which furnishes a résumé of the objectives in terms of the chief elements in the problem.

Discovery of logical relations.—The significance of the analysis and outlining of a problem lies in the fact that it furnishes a framework, a skeleton, so to speak, for the means to be employed in the attaining of objectives, and indicates the approach or processes of developing the objectives, and the objectives themselves. It may be argued that some problems consist of elements of equal importance, which do not necessarily suggest an inherent sequence or logical relation. There is an even balance among the parts, and one part or element is of no greater significance than any other. It is not so easy, then, to determine relationships as it is in the case of a problem which contains elements of different weights or that show inherently a logical or sequential relationship upon which the development of the conclusions may be predicated. The outlining of problems of the latter type is comparable to the construction of a building, because the work cannot begin just anywhere, and because certain things must be done before other things are done, that is, they must be planned in order and carried out in a definite sequence. Even in this latter type, the sequential relationships may at times be difficult to apprehend. But such variations with re-

gard to relationship or priority of elements do not necessarily alter the methods of procedure in analyzing a problem, determining its elements, and outlining it. Whatever the nature of the problem, the arrangement of the elements in an outline is important in serving as a scheme for a systematic gathering and interpreting of data as well as for the presentation of the data and exposition of the completed study.

The outline compared to a blueprint.—We see, therefore, that the procedure involved in developing the research through Step V led to a more complete analysis of the problem as formulated, to a definite recognition of the elements of which it is composed, and to a logically constructed outline. The work preceding the outline and the outline itself may be compared to the blueprints which chart the plans for a bridge, a building, a military operation, a new engine or machine—a guide without which the engineer, contractor, officer, or inventor would be seriously handicapped.

Guiding principles in procedure.—There are certain significant points which the research worker should keep in mind in undertaking this step:

1. That the work of analyzing the problem for the purpose of discovering its elements, of differentiating these elements, and of rearranging them in a logical sequential order by outlining, must be regarded as a definite outgrowth of the formulation. In other words, this step proceeds to amplify the formulated problem. If the formulation be disregarded, only desultory and aimless fumbling can result. The modus operandi must be firmly rooted in the formulation and all efforts at thinking the problem through must be guided by the objectives contained in the statement of the problem.

2. It follows that mere haphazard enumeration of points somehow related to the problem is to be avoided. Once the elements of the problem have been clearly discerned, they must still be related. To think is to discover relationships, and much thinking, even though deductive, is required to terminate Step V satisfactorily. This caution is not intended to imply that a careful notation of ideas occurring at random may not accompany the effort to weave the separate elements into a logical whole.

3. Considerable emphasis should be placed on discovering the basis for effectual outlining. At least two principles can be stated definitely: (1) the separate elements may be related in order of priority on the basis of an inherent quality that suggests their logical sequence and this quality must be discovered; and (2) the separate elements may be related on the basis of expediency if they suggest an equivalence, in order that the research procedure may be carried to its objectives in a systematic manner.

4. Each major element should be separated into its subsidiary or secondary elements, and these should be carefully arranged in logical order under the major element. The basis which should serve in determining the manner and extent of breaking up the major elements must be judged by the following: (1) the subelements should suggest a simple idea or concept, capable of definition, and that can be interpreted in one way only; and (2) the subelements should not only present the parts of the chief elements in terms of simple meaning and of definite relationships, but also should suggest the specific data or evidence for which they call.

5. If the processes of analysis, differentiation, and integration, when applied to the problem chosen for research, yield imperfect results, that is, if the analysis

reveals the presence of elements too widely diversified, so that the differentiation process would lead only to a still greater heterogeneity or lack of relation among the elements, making a coherent reintegration or outline impossible, then reformulation of the problem is indicated and necessary. Provided such a situation is not due merely to muddy or ineffective thinking, reevaluation of the problem in the light of its formulation and of the results obtained by the methods under Step V may reveal the following: (1) the problem may cover too great a scope; (2) the formulation may not strike at the core of the problem; (3) the formulation may contain multiple problems causing the objectives stated to be divergent or irreconcilable; or (4) the wording of the formulation may permit of erroneous interpretations. Whether one or more of these conditions prevail, reformulation or redefinition of the problem should always be preceded by a review of the results obtained in the preliminary survey under Step II.

Chief object of step.—It must now be clear that the fundamental object of this phase of research method is to explore the problem and to develop a plan of attack. This brings the research work to a vital stage. Not only is the concrete outline the essential basis for determining what data is required—the task to be discussed in Step VII—but it points directly to the logical position of the subsequent step.

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Chapter VII

STEP VI—CLASSIFYING THE ELEMENTS IN THE PROBLEM ACCORDING TO THEIR RELATION TO THE DATA OR EVIDENCE—DIRECT OR INDIRECT RELATION

Nature of the process.—This step is as important as it is difficult. It represents an essential link between the problem as developed and outlined thus far and the survey of the data or information required as suggested by the various and separate elements which the problem contains. Those experienced in research will undoubtedly understand the nature of those elements in a problem (1) which *can be* measured *directly,* or which bears a *direct relation to the data or evidence;* and (2) which *must be* measured *indirectly,* or which bears an *indirect relation to the data or evidence.* Such a recognition of difference in the elements is essential for the purpose of (1) determining the data required, and (2) assuring a proper interpretation of the data obtained with reference to the elements. It is primarily concerned with a study of the quantitative and qualitative differences in the elements, in order to select the necessary and proper statistical or information units, in terms of which all data must be expressed.

Elementary or homogeneous elements required.—In the task of breaking up the problem into its major constituent elements, and these, in turn, into their minor

or subsidiary elements, we saw that one of the primary objects, among others, was to obtain the various elements in *elementary* or *homogeneous* form. If they are not so obtained then the attempt to relate *composite* or *heterogeneous* elements to the data or evidence which must be provided becomes a difficult, if not an impossible, task. For illustration, it would be impossible to measure the quantity of grain in a granary which contained a mixture of wheat and hams, since the element, wheat and hams, is a heterogeneous one.

Relation of data to elements.—A research worker will meet with such problems a-plenty and he must guard himself against any slurring over or avoidance of the difficulty. Once the elements in the problem have been refined, or made homogeneous, he should begin to consider them in the light of their relation to data or evidence. This relation is either direct or indirect. Elements which bear a direct relation to data or evidence may be called "quantitative," while those which bear an indirect relation may properly be designated as "qualitative." It should be noted here that, under particular circumstances, "quantitative" elements may occasionally require an indirect treatment of the data or evidence by which they can be measured.

Illustration of direct relation.—A simple illustration ought to make clear the difference between the situation of elements which bear a direct relationship to the data or evidence, and that of such directly related evidence which, however, because of special conditions, require an indirect handling of the data or evidence. Let us return to the case of wheat and hams. If the amount of wheat were an element, it would be a "quantitative" one and would bear a direct relation to the number of bushels present—the data or evidence.

Should the wheat, however, be mixed with hams, the relation of the wheat to data or evidence would not be altered, but the data or evidence would have to be handled indirectly. Therefore, the number of hams must be known, their total cubic volume approximately determined and deducted from the total cubic space filled with wheat and hams; the results, divided by the cubic space per bushel of wheat, would give tolerably accurate data or evidence of the amount of wheat in the granary.

Illustration of indirect relation.—We now come to the other type of elements branded as "qualitative," those which always bear, as has been stated above, an indirect relation to data or evidence. The measures of these elements invariably consist of data or evidence in quantitative form, not necessarily in terms of figure facts only—representing weight, number of units, distance or space, and so forth, but in terms of degree, in concepts of more or less, as well. Invariably, such elements represent kind or quality in terms of degree and are indigenous to psychological or subjective states of individuals or society, and to forms of energy, such as light, heat, force, resistance, and so forth. Measures of these are by wave lengths, degrees of centigrade or Fahrenheit, horse power, volts, and so forth. Assume that demand for hams were an element in a problem. Demand springs from appetite, but does not proceed directly to the acquisition of hams. The data or evidence bearing on the source and nature of the demand must, therefore, be indirect. Such data or evidence may embrace the likes and the dislikes of individuals, customs and habits, income and outgo of earnings of households, price of hams, and so forth. A measure of these various factors may indirectly yield data or evidence

leading to an explanation of why hams are bought and consumed.

Other examples cited.—Below are some examples indicating the nature of the relation of the data or evidence to "quantitative" or "qualitative" elements in a research problem: shoe production in number of pairs, sales in number of dollars, costs in business, wholesale prices, number of marriages and divorces, size of markets, and volume of bank deposits represent data relating *directly* to the elements of a problem, although in the case of costs in business, for example, the element of cost may not be derivable in its elementary and homogeneous details, and must be subjected to some indirect device, such as that used in the illustration of the hams and wheat, in order to obtain the data or evidence of various unit costs. Outstanding examples of data or evidence presenting an indirect relation to the "qualitative" elements are: efficiency of management, skill of laborers, business pessimism and optimism, temperament of workers, motives for divorce, activity in markets, efficacy of a sales policy, and the like. Scientific procedure aims always to discover some quantitative measure or some indirect criterion in the form of data or evidence that is relative to these elements.

Classification of elements on basis of kind.—At this point it becomes necessary to say a word of caution against a possible confusion of the so-called "qualitative" elements, requiring indirect data or evidence, with the classification of any elements in a problem according to some inherent quality. This suggests a differentiation that should have been made in connection with the previous step, in order to insure the obtaining of the elements in an elementary or homogeneous form.

Brief reference to our previous examples will make this clear. If a research work contained the element "shoe production," the extent or objective of the problem might require a division of shoes into men's, women's, and children's shoes. The element "number of marriages" might call for a classification of marriages according to race or nationality of the parties. In addition, the "qualitative" element may require a similar statement of kind, as in the case of the "efficacy of a sales policy," which might demand a separate analysis of advertising, merchandising, and salesmanship. Or the "motives for divorce" may be needed on the basis of the motives of parties belonging to various economic and social classes.

Central aim of present procedure.—The central aim of the research procedure in this step is to survey and study the outline of the problem in order to determine the meaning of the separate elements in terms of their relation to the data or evidence. This interpretation of the elements according to the principles just set forth leads to a correct understanding of the mode of proof required; or, in other words, to a recognition of the connections which may exist between the data or evidence and the elements in the problem. Such a critical study of the elements is necessary for the purpose of discerning the statistical or information unit—the unit of data or evidence as predicated upon the nature of the elements. And it is highly important that the relationship existing between the elements and the data or evidence in terms of these units be clearly apprehended. The mechanics required in this procedure may consist of such notations opposite each element in the outline of the problem as will distinguish elements bearing an indirect, from those bearing a direct, relationship to the

data or evidence. If desired, a separate grouping of the elements may be made.

Now it must be observed that each element, in terms of its related statistical or information unit of data or evidence, is definitely linked to the data or evidence which may be suggested. The research worker may ask at this point why the relationship existing among any number of elements does not constitute a new element in the problem in connection with this step. The answer to this query is that such observed relations do constitute a new element, but that it must be considered as secondary in point of time. As will be demonstrated, this aspect of research methods becomes evident at a later stage, after the separate elements, as determined by the procedure in Steps V and VI, have been subjected to an analysis predicated upon the data or evidence gathered in relation to these original elements. In other words, such secondary or derived elements arise when meanings and inferences are drawn from the data or evidence bearing upon the elementary and homogeneous elements in the outline of the problem. It ought to be clear that such relationships as may exist between the primary elements in a problem cannot be discovered until the separate primary or subsidiary elements have been analyzed in the light of the data or evidence relating to them. The researcher must be warned not to place the cart before the horse.

Provided the research worker has clearly grasped the significance of the kind of relations which may exist between the various elements in the problem and the mode of proof or the manner of their connection with data or evidence, he has set the stage for the next phase of research procedure.

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Chapter VIII

STEP VII—DETERMINING THE DATA OR EVIDENCE REQUIRED ON THE BASIS OF THE ELEMENTS IN THE PROBLEM

Position of research at this stage.—By this time, the research student has a complete program, a well-developed plan. He has analyzed the problem for the elementary or homogeneous elements it contains, so far as he could understand these in terms of their direct or indirect relation to data or evidence before the actual data are at hand. This has led him partly to recognize what is required in the way of proof, including also the nature of information or statistical units in which the data must be expressed. This task, in the preceding step, was primarily of subjective significance to the research worker, for it provided the link to the present step.

Linking the elements to evidence.—It may be assumed that the tentative formulation of the problem, evolved earlier, has been subjected to reformulations or redefinitions, in order to bring it in line with definite objectives subsequently conceived, and to provide a logical outline on the basis of an inherent or expedient relationship between the elements. This revaluation, properly performed, leads the researcher to the next step in method—that of determining the exact nature of the data or information required for each elementary or homogeneous element in the problem. These data

and information are the keystones to the meanings, inferences, and ideas to be derived later. Let us appeal to a graphic device for the purpose of implanting the idea.

I. Formulation of the Problem:	*Relation to data or evidence*	*Data or information required*
1. Amplification of the purposes or objectives of the inquiry.		
a. Subsidiary or secondary purposes or objectives, if any.		
2. First element in the problem of initial and primary importance.		
a. Breaking up this element into its constituent parts.	Direct	Output per man. Bushels produced, or cost per unit.
	or	Number of marriages.
(a) Further separation of subsidiary elements, until elementary and homogeneous elements are arrived at as nearly as possible.	Indirect (notes on units and mode of proof)	Temperament of workers Psychological tests, or race. Motives for divorce Legally declared reasons. Efficacy of sales policy. Returns compared with previous ones, other factors eliminated.

3. Continued—see page 36.

This brief illustration ought to clarify the purposes of the present step. The primary aim is to determine the exact nature of the data, the facts, or the information required to test, measure, or provide a basis of proof for each element. At this stage in research methods,

the significance of the data, in terms of evidence, upon which future inferences and meanings are to be based, must be anticipated or forecast to some extent. It should be noted here that so soon as the researcher inquires, "What must I know about each element in the problem and from what data or information may I obtain the evidence?" he begins to discern the interrelations between the inductive and the deductive methods of thinking, for it must be clear that, before he can definitely make plans for collecting the data or evidence required, he must know what data or evidence the various elements call for. If the analysis of the problem has revealed the elements in their elementary or homogeneous form, the nature of the data or information required has been strongly suggested; but what evidence they might yield must be inferred, anticipated, or forecast. Again, we cannot refrain from calling attention to the fact that processes of induction and deduction press with the initiative of one and then with that of the other, while at times they may disengage for a brief moment to do their work independently.

Meaning of terms.—Before we proceed to develop this step in the procedure it will be necessary to consider the meaning of the terms "data, facts, or information," "evidence," and "inferences" or "suggested meanings." For purposes of research evidence should be taken to imply two things: (1) the objective "data, facts or information"; and (2) the meanings these suggest, or the "inferences" drawn from them, or attested by them. "Data, facts, or information" mean "something given or admitted—as a fact on which an inference is to be based," while "suggested meanings" or "inferences" are the reactions of the mind to the observed data, or the result of reflective thinking, and

therefore depend upon the researcher's mentality, emotions, feelings, and so forth, for their carrying out. Evidence, then, is a composite thing, depending, on the one hand, upon objective data, facts, or information, and, on the other hand, upon the quality of the researcher's intellectual endowments and emotional disposition. The definition of the word "evidence" clearly implies this: "that which makes evident or manifest; that which furnishes or tends to furnish proof; any mode of proof; *the ground of belief or judgment.*"

Importance of this procedure.—A cogent point of view regarding the necessity for realizing the importance of adequate analysis of the elements in the research problem, in order to apprehend in its entirety the exact data required as evidence, is to be found in a recent article.[1] "The scientific study of any subject is a substitution of businesslike ways of 'making sure' about it, for the lazy habit of 'taking it for granted' and the worse habit of making irresponsible assertions about it. To make sure, it is necessary to have done with a careless 'looking into it,' and to undertake precise observations, many times repeated. It is necessary to make measurements and accountings, to substitute realistic thinking (an honest dealing with facts as they are) for wishful or fanciful thinking (a self-deceiving day-dreaming) and to carry on a systematic 'checking up.' . . . Science is nothing more than getting at facts, and trying to understand them."

Actual procedure required.—Turning now to the actual procedure in determining the data or information required, the outline of the problem developed in the previous steps continues to serve as an important in-

[1] Franklin H. Giddings, "Societal Variables," *Journal of Social Forces*, March, 1923.

strument. It is the blueprint of the research undertaking. Metaphorically speaking, the residual elements, as outlined, are the guideposts which point to evidence. The task of critically examining each element now, in order to determine the exact nature of the data, facts, or information required, is merely following these guideposts to the data.

The data determined as necessary should be noted opposite each element in the outline. After this task has been satisfactorily completed, all the data so noted should be evaluated in relation to the elements or to the problem as a whole. This requires that the whole outline, with its main and subsidiary elements, be examined, to discover whether the data regarded as necessary completes the basis of evidence called for. It may be desirable or necessary to obtain additional or supplementary data in reference to certain elements in the problem which might have defied reduction to their simplest terms, or whose relation to data indicated or required is extremely indirect or distant. This, however, often would be more to the point after the data considered necessary have been collected, and while their analysis and interpretation are under way, for then a direct inspection of the data is possible in order to determine their value as evidence.

Considering the evidence as a whole.—The research worker should now ask, "Will these data determined as necessary from the suggestions of mode of proof for this single subsidiary element, combined with the data concerning related subsidiary elements, give me an adequate basis for inferences leading to the evidence upon which a partial conclusion may be formed regarding this one chief element?" This question should be repeated for each minor element, singly and in its relation

to other minor elements, under the several major elements, until the whole problem has been critically surveyed, in order to assure the researcher that no breach appears in the mass of evidence required for attaining the objectives of the problem.

Necessity of distinguishing the elements.—Throughout this procedure the researcher should remain aware of any difference between direct and indirect relation of data and evidence to various elements. Especially is this important in connection with the so-called "qualitative" elements, for the more indirect the data or facts or information the less certainly do they serve as bases for inference, for the more unrelated might become the evidence bearing on these elements. Under such conditions, meanings or inferences will naturally be more difficult to derive and more likely to go awry. For example, if an element consisted of consumers' motives for buying particular articles, these motives may be indirectly determined by use of such indirect data or quantitative criteria as the price of other articles adaptable to similar use, as temperature and rainfall influencing demand, as church attendance or membership indicating religious beliefs which may affect the choice of articles, or as other roundabout modes of proof.

Reformulations.—In addition to acquiring the above discrimination, the researcher, his critical faculties whetted by the difficulties encountered in carrying through the procedure under this step, may have discerned gaps or inconsistencies in the problem as he first formulated and outlined it, so that some reformulation and some further differentiation of the elements seem imperative or desirable. Some elements may require further decomposition, in order that they may be sus-

ceptible to a possible form of proof; a redistribution of the elements in the outline may seem desirable in the light of the nature of anticipated evidence, meaning that the elements now appear to be of different weight than formerly and, therefore, should occupy different positions in the outline. In such recasting and changing of the problem and the outline, the objectives to be achieved by the research should not be lost sight of.

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Chapter IX

STEP VIII—ASCERTAINING THE AVAILABILITY OF THE DATA OR EVIDENCE REQUIRED

Summary of previous step.—The procedure under the previous step yielded the following results: (1) each element in the problem was studied and interpreted to determine the needed data or evidence and these were noted; (2) elements requiring indirect proof were carefully studied, in order to ascertain the mode of proof called for and the nature of the data or evidence necessary; (3) the major elements were subjected to analysis in order to discern whether the data indicated as required opposite each subsidiary element, as well as whether all the data considered in combination, were sufficient to complete the evidence; and (4) after each major element was analyzed, the problem and outline as a whole were carefully examined, in order to determine the degree of coherency, completeness, and authenticity of all the data indicated as required. It was observed that, if additional evidence was required to complete the necessary proof or to achieve the objectives of the research, this should have been noted, and that such a circumstance may arise if it is impossible to reduce some elements to their elementary or homogeneous form, because of their inherent nature; or when the information or data required are themselves not obtainable in such pure or refined units as a com-

plete disintegration of the elements demands. As was seen, judgment must often be deferred in these cases until the actual data have come to hand.

Logical position of present step.—The logical position of the present step must be self-evident, because the research worker cannot proceed to determine the availability of the data or evidence unless he knows *exactly what data he requires—not what he thinks he needs.* The formulations of the problem, the separation and outline of the elements, the recognition of the actual data required in relation to the elements, all have prepared solid ground for this step, and should have offered pregnant suggestions regarding the scope and nature of the data designated as required.

Nature of present procedure.—The task of ascertaining the availability of the data presents two phases: (1) the sources of the data must be discovered, and (2) the availability of the data from these sources must be tested. The selection of sources, if it is a matter of choice, should be governed by the fundamental test of reliability. However, data may not be available from the most reliable sources, for the reason that the sources are inaccessible, or that those in command of them refuse to produce the data. In this event, we are forced to admit a secondary test of availability, and the matter becomes a compromise between reliability and availability. The first question is, naturally, "What constitutes reliability or authenticity of source?"

Sources of data.—Data may be derived from primary or from secondary sources. These broad but comparatively distinct categories should be clearly recognized as the lairs of the data required in research work. Primary sources are the places of beginnings, or origins, of all new data which have been gathered, or are

in the process of being gathered, in direct connection with some particular research undertaking. These new or original data might well be called primary data. Secondary sources are those that yield data which were at one time primary, new, original, and collected for some specific research purpose, or collected for a variety of such purposes. These data, because they are used by some person or agent other than the individual who collected them originally, might be designated as secondary. These secondary sources consist invariably of some kind of publication which may present the data in a variety of forms, according to the various purposes for which they were gathered, or according as they have passed through two or more republications.

Reliability of data and sources.—The comparative reliability of data obtainable from these two sources must be judged by the relation of the researcher to the original sources. Primary sources are usually considered more reliable for data of a particular type, for the reason that the research worker, having experienced personal contact with them at their source, is aware of their significance in the light of the conditions and circumstances under which they were obtained, and thus has gained a vital knowledge of their qualifications, limitations, and inherent nature, and of the imperfections they may manifest as evidence for conclusions. The reasons cited for considering primary data as reliable should provide the basis for an understanding of the limitations usually imputed to data procured from secondary sources. The degree of reliability of data from secondary sources depends upon the answers to two questions: "How, under what conditions, and for what purposes were the data originally collected?" and (2) "What changes have the data undergone since their

collection and during their publication and perhaps republication?" To the extent that satisfactory answers are found to these questions, secondary data may approach, though they can never equal, primary data in degree of reliability. As indicated, this is so, because the research worker lacks first-hand impressions or suggestions gained by actual acquaintance with the data at their primary source, and so fails to grasp the complete meanings from the data which lead to sounder inferences.

The judgment that primary sources are, as a rule, more reliable than secondary sources must be self-evident in all cases when the investigation covered the same scope and employed the same methods of collecting data and obtaining data of the same particular type. But where data obtained as evidence, relating to the same problem or elements of the problem, are of different types—when data drawn from a secondary source are not, for example, the specific kinds that are drawn from a primary source—then the data from secondary sources may prove at times more reliable than the dissimilar data drawn from a primary source. It may be seen, therefore, that the whole question of reliability of sources cannot be settled by the decision as to whether they are primary or secondary, but must take into account in equal measure the similarity or dissimilarity of the data obtained from them.

To illustrate: if a research problem required data on market rates of interest and volume of cash deposits in banks, primary sources for either type of data would undoubtedly be more reliable than secondary sources; but the secondary sources for rates of interest might easily be more reliable than primary sources for bank deposits, because the actual figures on bank deposits

might not be obtainable with sufficient accuracy to compare with the dependability of quotations on interest rates from a secondary source such as *The Commercial and Financial Chronicle.*

Survey required.—The first step, then, in ascertaining the availability of data, is to make a survey of the primary and secondary sources as suggested by the data required. The exact sources must be indicated. This usually requires considerable study and thorough investigation, in fact, much more than is often thought worth while to devote to this phase of research. Especially is this true, if it be found that primary data are not available, or that more time and expense are required to obtain them than the research worker can afford. In such case, recourse to secondary sources requires usually a choice from among many, and a thorough examination and critical comparison must be made of the various available secondary sources, to determine their relative degree of reliability.

Reasons for survey of sources.—It is hardly possible to be too thorough in conducting the preliminary survey for available and reliable sources for data, for a painstaking examination of all possible sources should not only produce criteria of reliability and availability, but should enlarge the field of choice. Furthermore, the efforts expended for this purpose will afford a clearer knowledge of the nature of the data which is to serve later as the basis for inferences and evidence, for the choice of sources and data can make or break any attempt at scientific research.

An indisputable corollary to the failure to do this work properly, to a compilation of data from faulty sources, is that such data must be scrapped later on, as their unreliability becomes manifest through analysis

and interpretation. Such lack of thoroughness is an expensive waste of time and resources both in the gathering and the analysis of such defective data.

Rules for selecting sources.—There are certain fundamental rules which the research student should keep clearly in mind in selecting reliable sources and in determining the availability of the data which he seeks:

1. New data selected from reliable primary sources should be used whenever possible. Certain exceptions to this rule must be admitted under specific circumstances. These are: (*a*) if the scope of the primary sources is too extensive, requiring more time and resources than the research worker has at his disposal; (*b*) when the methods that must be employed to tap the primary sources for data would be ineffective if used by a research worker whose status is not such as to command authority, or whose reputation is not such as is required to obtain responses from individuals in control of the sources; and (*c*) if certain secondary sources, in comparison with available primary sources, seem almost as reliable and the additional effort required to regather the data from the original sources does not compensate for the difference in reliability. Under (*b*) it must be observed that the matter of scope of sources for primary data may involve the question of sampling. It may be neither desirable nor necessary to include every source from which new data may be derived, such inclusion depending entirely upon the purpose or the objective of the research. The principle of sampling may then be invoked, that is, every source of new data should be given equal opportunity for being represented by the new data collected. This opportunity may be provided on the basis of random selection, or on that of intelligent and unbiased choice.

To illustrate: The census-taker going from house to house collected new data on population from primary sources. These data, when combined and published in Census Reports, really become secondary data, even though they are highly reliable, and the Census Reports must be regarded as secondary sources.[1] Now let us turn to the exceptions noted. If a researcher desired to obtain information on the growth of city, as compared with the growth of rural, population, the retaking of the census would be a task beyond his scope and means. Even if such a procedure were possible, his status as a private investigator would no doubt make the gathering of correct data improbable, since the individuals questioned might resent such an inquiry. Again, even though the retaking of the census by the researcher as a private investigator did not offer serious handicaps, it would remain obvious that the secondary data available in the Census Reports would be sufficiently reliable to warrant their use as a substitute for the time and expense required in retaking the census.

Finally, the purposes of the researcher may be such that he may resort to a process of sampling the growth of the population in certain representative cities and rural sections.

2. If secondary sources are used, the data should be obtained from sources as near as possible to the primary ones from which they were originally obtained. Naturally, the repeated use of data subjects them to the risk of errors, omissions, changes, or revisions. Knowledge concerning the circumstances under which the data were originally obtained becomes more obscure

[1] A rigid definition of secondary sources would include Census Reports under this head, although by some these Reports are regarded as primary sources. The point of view here taken is that they are secondary, although highly reliable. See pp. 59, 60.

through successive republication. Although data are available in great quantity from secondary sources, determination of their reliability presents many pitfalls, and these should be avoided by careful and critical study.

3. Joint use of both types of sources should be resorted to whenever it appears that any one source is insufficient to furnish proper and complete data in reference to any element in the problem. This rule does not refer to the necessity of often using both primary and secondary sources in the research as a whole; but, as was just indicated, it refers to the combined use of both types of sources in connection with obtaining sufficient evidence for the individual elements. If the survey of sources for data leads to an impasse, where choice of no one source seems desirable, then several sources should be used in order to check the data procured from each. Unreliability of data must be offset, so far as possible, by increase in the amount of data bearing on a given element, so as to attain completeness of evidence so far as possible. A sufficient quantity of data will insure some degree of reliability and will permit, within limits, tolerably accurate inferences and conclusions.

Unreliability generally probable.—The research worker must remember that data may be unreliable whether obtained from primary or from secondary sources. For example, let us recall the previous case of the investigator who attempts to take a population census. His lack of authority to secure correct answers from heads of families may lead to the obtaining of very imperfect primary data. In like manner, a researcher, questioning a business executive, may gather unreliable data, for the reason that the executive may give the in-

vestigator estimates of his volume of sales, "off-hand," or may even willfully distort the actual figures as known to him.

Difficulty of recognizing sources.—At times the clear differentiation of a primary from a secondary source is very difficult. For illustration, let us take again the case of the business executive. If sales are the data desired, the question, Which source is to be considered primary, (1) the business man's verbal statement, (2) the accounting records of his concern, or (3) the financial statement which he has submitted to a bank? might properly be asked. Barring attempts to falsify the data, all three might be considered primary. If willful falsification is a possible factor, then the private accounting records might be the only sources that can be classed as primary. No infallible guides can be cited to cover all cases, for each case is characterized by its own conditions, and similar problems pervade all fields of research. A few more illustrations must suffice. In the case of data on the motives for divorce, the question might well be raised whether the court records, on the one hand, or the parties themselves, on the other, represent the primary sources for such data. It must be obvious to a research worker that great disparity often exists between the legal grounds for such motives in the various states and the actual motives entertained by the parties. Again, data consisting of stock exchange quotations may raise the question whether the prices registered on the ticker tape, or the publications of prices in daily newspapers, or both, are primary sources. To illustrate again, in obtaining data as a basis of legislation, Are the opinions of those interested, or the basis upon which these opinions rest, primary sources? These examples seem to imply that

there is a twilight zone between primary and secondary sources and between reliable and unreliable primary sources, and that any decision must rest on detailed knowledge of the actual cases.

Means of obtaining new data.—New data may be obtained from primary sources by means of (1) observation, (2) experimentation, and (3) questions, through personal interview, letters, or questionnaires. Observations must be made in the field of research as it exists in the real world, where the researcher has no control of the situation, being, as it were, an interested onlooker. Experimentation, on the other hand, implies that the conditions under which he may observe for new data are under control, as in a laboratory. Once the reliability of the data has been determined according to the principles outlined above, the next task before the research worker is that of testing the availability of the data from the sources selected. This should have been preceded by a careful notation, opposite the required data appended to the statement of each element of the problem in the outline, of the sources which it is intended to use. In testing the availability of secondary data, a procedure is recommended similar to that outlined in Step III in connection with developing a bibliography. To test the availability of new data from primary sources, the following procedure is necessary: (1) If new data are to be obtained by means of observation, sufficient sampling should be done in the field to ascertain the probable results and to feel convinced that the data are obtainable. (2) If experimentations are to be made, a representative number of trial experiments should first be performed, and care should be exercised to make sure that the chosen conditions can be again created and are amenable to

control when the complete experiments are performed. (3) If questioning be the method, then selected interviews should be conducted and actual letters and questionnaires should be sent to persons representative of the number and classes to be addressed. Further aspects of this procedure, and of the forms involved in carrying it out, are adequately discussed under Step X, to which the research student is directed at this point for suggestions.

Final considerations.—It is desirable to note carefully, in the outline opposite the entry of the required data appended to each element of the problem, the sources to be used and the means to be employed in obtaining the data. In order to complete this step satisfactorily, the research worker should study the results of his tests of the availability of reliable data, to determine whether further exploitation of possible sources is necessary, a proceeding which might eventually require a partial reformulation of the problem and a recasting of its elements, and to bring the whole problem in line with the availability of the reliable data found to be necessary.

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Chapter X

STEP IX—TESTING THE SOLVABILITY OF THE PROBLEM

Two general phases of research procedure.—In a sense, research procedure consists of two general phases: the first phase covering the procedure ending with Step VIII, and the second phase embracing the steps following the present one to the completion of the research. The general character of the research methods belonging to the first phase was preparatory—breaking the ground, or developing a program of attack. The research worker is now at the crossroads. In the present step he is asked to pause and take stock, to evaluate the results achieved, and to pass judgment on his own work. He is exhorted to arrive at a definite decision in respect to the objectives to be attained and to the solvability of the problem. This critical reflection may bring him to one of three decisions: (1) the problem may be solved, or may be carried satisfactorily to its objectives; (2) there is a necessity of modifying the formulation of the problem and trying another course; or (3) the entire problem must be rejected as unsolvable.

Significance of reformulation.—In spite of the emphasis on reflection and decision at this particular point in the researcher's progress, it is not to be supposed that he has or should have ignored all previous forebodings of an unfavorable outcome. As has been pointed out repeatedly, continual vigilance should be exercised to dis-

cern developments in the procedure which call for modifications in the problem and the methods employed. Reformulation and reanalysis of the problem and reoutlining of the elements as the procedure progresses through the steps preceding this one may overcome to a large extent any suggestions that the problem may be unworkable. In the same way, if the sources selected for reliable data prove unproductive according to his tests, there may still be the possibility of selecting other sources. This requires another, or a more critical, survey of the sources and data pertaining to the problem.

Reason for present step.—The research worker should not, therefore, adopt the attitude that all forebodings of failure in attaining his objectives are simply to be ignored until the present step is reached, and that he is then suddenly to lift the floodgates and allow all these indications to overwhelm him; nor, on the other hand, is he urged to throw the research problem overboard at the first ill-omen. Rather, he should assume a sensible attitude—one which will lead him to make intelligent reformulations and recastings of the problem whenever unconquerable difficulties are encountered along the path originally laid out, and cause him to await composedly the completion of Step VIII, in order to arrive at a sound basis for decision. The results obtained by this preceding Step VIII are vital, and often are the determining factors in the question of whether the problem shall stand or fall.

Status of work accomplished.—The research work as carried on up to this point may be compared to a labyrinth of routes or ways, projected or incomplete, along which, at irregular intervals, are deposited tested materials to be used in completing the construction. That is, the objectives of the research are clearly seen,

the lines of procedure are laid out and connected, the bridges from elements to evidence are planned, the data to be employed are known, the sources from which data are to be obtained have been determined, and the reliability and the availability of the data have been tested. All of these serve the researcher in the present task before him.

Erroneous methods of judging solvability of problem.—The question now appears a triple one: "Can the problem be solved?" "What is required in 'testing' its solvability?" "By what criteria or scientific standards can these tests be performed?" Before we presume to find answers for these questions, we must call attention to certain erroneous methods often used. (1) Some individuals unfamiliar with research methods confuse the objectives of an inquiry with its conclusions or solutions, conceiving the objectives to be conclusions, and accepting them as the basis for judging the solvability of the problem. Naturally, in determining the objectives of a research problem, vague ideas of the nature of the conclusions are likely to intrude; as the objectives become more definite, during the formulating and analyzing of the problem and in the process of determining the nature and the sources of the data and evidence, the general outlines of the conclusions may be boldly suggested at times. But, to the inexperienced in research work, these vague ideas furnish the favorable winds on which his wish-thoughts sail to port, deluding him into the belief that they are the full-burthened argosies of his endeavors. How, then, is he to be judged if he accepts these faulty criteria and brings forth an unwise decision as to the workability of the problem? (2) Another pitfall for the untrained is the temptation to take the logical development of the outline of the

problem as the criterion upon which to base its solvability. In such cases, he fails to realize that the steps which prepared the elements for the outline, and even the outline itself, were chiefly, if not entirely, the result of tentative planning of the research problem and the methods to be employed. The outline itself is to a large extent a "psychologically logical" construction, based on relationships perceived between the elements in the problem as set forth on page 37. But these relationships are entirely conditional, and their validity must meet its real tests in the subsequent step—that of analyzing and interpreting the data and the evidence (Step XII). Although a logically developed outline is indispensable, it cannot be made to serve as the basis for decision as to the workableness of the problem, for this would lead to unwarranted deductions and forced inferences. The researcher has outgrown the temptation, happily, to accept preconceived conclusions as criteria of solvability; but he is still in danger of accepting a logically developed outline as a criterion of success or failure, without the additional and important test of support to be found in the reliability and availability of data and evidence.

Criteria of good research results.—Let us examine briefly some of the challenges often flung at research workers by intelligent critics. Among these are the following: "Exactly what was your problem?"—"What were the elements in the problem, or the scope of the problem?"—"What proof have you?"—"What were the bases of your inferences and conclusions?"—"Why can one not follow you?"—"Why did you not derive sound and definite conclusions on the basis of all these data?"—"Why were your work and data so poorly handled?"—"Why did you use these sources for your

data?" The idea back of all these questions is one of method and evidence. The tests or criteria with which the solvability of a research problem seem obviously to be concerned are the nature of the method used and the scope and nature of the data and evidence obtained. In other words, the question, "Is the problem amenable to scientific treatment?" must be answered in terms of what are proper criteria of sound methods and of complete evidence.

Meaning of scientific method.—In general, scientific method or treatment implies a logical derivation of conclusions by means of inferences correctly drawn from reliable data. It implies, further, that the procedure involves a methodology such as that developed in the preceding steps in this book, and, in addition, such constructive analysis as that outlined in the succeeding steps, an analysis which is concerned with the collecting and weighing of evidence, the developing of inferences, and the logical relating of these inferences to the aim of discovering the conclusions. Valid conclusions are predicated upon sound research methods. Whether the conditions and tests of evidence in the research problem permit of the application of sound or scientific methods in the analysis and interpretation of the data to come can, as a rule, be determined with considerable accuracy at the present stage of the research work.

Actual tests to be used.—The consensus of opinion relative to what are proper criteria or tests of sound methods and the necessary conditions for their application may be stated in terms which admit of practical application, and by which the workability of an actual research problem may be judged. In reference to sound methods, these are: (1) delimiting the problem by accurate formulation and reformulations; (2) defi-

nite statement of the objectives of the research work; (3) thorough analysis of the problem in order to break up the elements into their elementary or homogeneous forms; (4) integration of these elements into a logically related whole by means of outlining; (5) definite recognition of the relation of the elements to the data required. The conditions necessary for the application of these methods are: (1) a field of research containing definite subjects or topics for investigation; (2) a survey of the field revealing specific gaps in verified knowledge, possible extension of inquiry beyond present limits; or obsolete portions suggesting untenable knowledge; (3) the possibility of refining the elements in the problem so that the data required for evidence is definitely determinable; (4) the availability of a sufficient quantity of reliable data to permit the derivation of correct inferences and sound conclusions.

Final questions.—The basis for a decision regarding the solvability of the research problem must be in the information gathered by applying these principles to the work as far as it has gone. Are the objectives definite and clear? Does the whole research plan so far evolved point directly to those objectives? Are the data available sufficient for reliable evidence? Are they amenable to definite interpretation or are they sufficiently suggestive of clear meaning to serve as bases for inferences? Might these meanings and inferences reveal the necessary relationships from which conclusions —abstractions and generalizations—may be derived? Satisfactory answers to these questions will reveal the nature of the decisions which was the object of this step.

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Chapter XI

STEP X—COLLECTING THE DATA AND INFORMATION

Setting of present step.—As was indicated at the beginning of the previous step, the student is now ready to enter the second phase of research procedure, provided the attainment of the objectives of the problem was assured by the tests just completed. This phase begins with a consideration of the methods and procedure in collecting the data and information. The basis for this step was securely laid in Steps VII and VIII. In the former, the data and evidence required were definitely determined in relation to each element in the problem, while, in the latter, the availability and the reliability of these required data were reasonably well assured by an adequate sampling of the sources—primary and secondary. These two steps immediately preceded the task of making sure whether the problem is workable. If a positive decision was reached, then the collection of the data is the next logical step in research procedure.

Preparations for procedure.—A thorough review of the outline of the research problem is a matter of the first importance at the beginning of this step. The outline should contain, or should have attached to it in convenient form, the results of each step. Such a re-

view is desirable in order to fix clearly in mind the nature, the form of the data, together with the sources of such data as were found to be necessary to the completion of the research. Without a precise understanding of the sources and data required, the procedure of collecting the data is likely to be desultory and meaningless. Critical study of the elements in the problem, together with the required data determined upon, should net concise knowledge of the nature of the data that are to be collected. It should also suggest to the researcher something of the form in which they should be obtained, though the exact form in which they may be obtainable depends ultimately on the nature of their sources. Thorough understanding of the sources to be used insures ability to apprehend not only the form of the data to be obtained and perhaps even the nature of the statistical or information unit derivable from them, but also the method or procedure which might be most effective in obtaining the data from their sources. The method and procedure to be employed in collecting data, then, as may be inferred from the foregoing, are clearly predicated upon the nature and form of the data required and upon the nature of the sources. These considerations afford a logical basis for the task confronting the researcher in the present step.

Methods of obtaining data from primary sources.—If the data is to be obtained from primary sources, the methods or procedure from the standpoint of the researcher may be either direct or indirect. In case the direct method is employed the data are obtained through:

1. Personal observation of the phenomena under actual or real conditions.

2. Personal observation of the phenomena under artificial or arbitrarily created conditions.
3. Personal interview.
4. Personal correspondence.
   a. Letters.
   b. Questionnaires.

Indirect methods obtain when the data are procured through:

1. Assistants or hired investigators representing the research worker, who may be instructed to employ similar means as indicated under the direct method.
2. Utilizing previously or currently collected data of others, provided the data are collected for the sole purposes of publication, that they have undergone no changes or only minor ones, and that the methods and circumstances connected with their collection are clearly and completely understood. These data, which, in the strict sense of the term, are secondary, may be considered of great reliability as we have already noted, and may be absolved from the rigid and general tests regarding the primary or secondary nature of their sources. In other words, such data, when they meet the above requirements, may be considered as primary for all practical purposes.

Means employed in observation.—The research worker should observe certain general rules when employing the specific means of obtaining data above enumerated. Beginning with the method of observation, we must recall that this method may be used with,

or without, control over the conditions under which the observations are made. For example, whether a retail store can be located profitably at the intersection of streets X and Y would necessarily require, among others, data representing the amount of traffic, vehicular and pedestrian, passing this prospective location. Since the researcher cannot control the conditions under which the data are to be obtained, the observations are made in a real world. On the other hand, were he contemplating the construction of a new factory with the object of securing the most favorable conditions for production, he might wish to conduct an experiment by observing the behavior or work of a given group of factory hands under certain conditions of temperature, humidity, and light, these conditions being arbitrarily brought about and varied at will. It is not possible here to describe the intricacies of the experimental method of research, and we must pass on, being satisfied to indicate the fundamental distinction between the two types of observation.

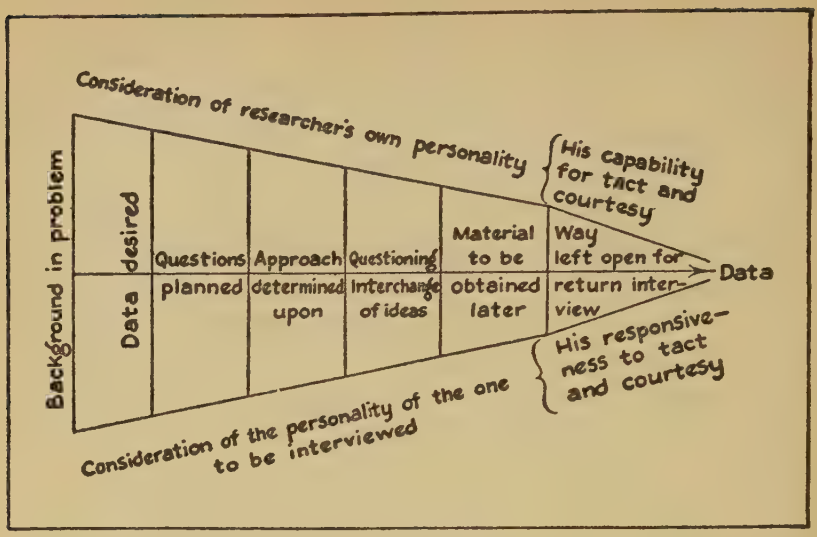
In considering the employment of observations conducted under real conditions, it is of importance to decide whether sampling is to be employed, or whether the entire field is to be covered. If sampling methods are employed, the observations might seem to fall in the class of experimental observation, but actually they are random observations made under selected conditions of time and place which remain uncontrolled. The principle of sampling which applies here has already been stated on page 62.

Rules for conducting observations.—A well-formulated plan for conducting observations under actual, or uncontrolled, conditions should include the following:

1. A clear definition of the phenomena to be observed—meaning that the statistical or information unit should be definitely ascertained.
2. Cards or sheets upon which the data are to be recorded.
3. Entries or headings on the cards indicating the form and units in which the results of the observations are to be recorded.
4. A definite decision concerning the scope of the field to be included in the observations.
5. A careful selection of the basis of sampling, should the sampling principle be adopted.

In conducting experimental observation, that is, under conditions arbitrarily laid down, or controlled, suffice it to say that it must be accurately understood just what conditions are being eliminated, what substituted for, or what created.

Interviews.—If the data are to be procured through personal interview, the problem becomes one of a psychological nature, for the research worker is brought face to face with the "living source," and the procedure is similar to that which is used in the interrogation of a witness, or in the newspaper reporter's interview. The object of an interview is to find out what another individual knows, or what data he may possess, and then to furnish such stimuli in the form of questions as will cause him to disgorge the information. To be successful in this often trying process, it is highly important to be armed with a plan which takes into account not only the data desired, but also the personalities of both the researcher and the individuals to be interviewed. A graphic idea of the plan may be presented as follows:


Consideration of researcher's own personality
His capability for tact and courtesy
Background in problem
Data desired
Questions planned
Approach determined upon
Questioning Interchange of ideas
Material to be obtained later
Way left open for return interview
Data
His responsiveness to tact and courtesy
Consideration of the personality of the one to be interviewed

Certain definite rules should be observed in planning and carrying out interviews:

1. Prearrange all interviews by phone or letter, with attention to:
   a. Selecting the right persons—those who are in a position to know and have the authority to divulge information.
   b. Choosing the right time and place.
   c. Facilitating the contacts through intermediaries or by interesting the persons to be interviewed in the object of the interview.
2. Prepare for the interview by:
   a. Carefully considering and outlining the points on which data are desired.
   b. Studying the chief elements in the problem around which the interview is to center.
   c. Testing, if possible, the plan of the interview upon other individuals of the class of the person to be interviewed.

3. Consider carefully the psychological elements important in:
   a. Approaching the parties.
   b. Asking the questions or exchanging ideas.
   c. Keeping to the subject.
   d. Stimulating responses.
   e. Timing the length of the interview.
   f. Handling differences of opinion.
   g. Obtaining definite and correct answers.
   h. Seeking private or confidential information.

Noting results of interviews.—No specific formulae can be suggested by which all interviews may be conducted satisfactorily, for the objects of interviews, the psychological considerations, the time and circumstances under which interviews may have to be conducted vary greatly. In so far as the mechanical aspects of interviews are concerned, it is often unsatisfactory to make notes while the interview is in progress, although it is often possible cleverly to disguise such jottings as toying with a pencil on a newspaper or a scrap of paper. The greater portion of the data obtained must be mentally retained and set down or written up immediately after the interview.

The interview may develop the fact that more information is obtainable later, either by a return interview with the same person or with other persons in the organization, or by reference to records, reports, and so forth, which may be available. The research worker should be alive to suggestions of such opportunities at all times during the interview. However, care should be exercised to prevent the person interviewed from offering these supplementary data in order to quash the interview, which may occur if he is unwilling to be

questioned, or if the researcher shows an overeagerness in obtaining these. It might be found later that such records or reports do not offer the information desired.

Correspondence.—The final means of obtaining data from primary sources is by correspondence. If letters are employed, the principles outlined in connection with the conduct of interviews are applicable in a large measure. Such letters should (1) enlist interest, (2) state succinctly the object of the inquiry, (3) make the request in simple and brief form, and (4) close with a tactful and graceful emphasis on the necessity of making a reply. But the research worker must be cautioned not to rely on letters as an effective means of collecting data. Letters may be employed when the nature of the data required is comparatively simple and general; otherwise they should be used only in connection with obtaining information in regard to other relevant matters not data, unless the data are in the form of reports, records, and so forth. Their use is of course necessary in accompanying questionnaires, which are far superior to letters as means of obtaining research data. This accompanying letter should contain: (1) the object of sending the questionnaire; (2) a courteous appeal to the interest of the addressee, either on the basis of the importance of the inquiry, of mutual interest, or of recognition of the authoritative or monopolistic position of the addressee in reference to the data desired; and (3) if necessary, explanation of the form of questionnaire, of the questions, or of the answers. It must be obvious that attention should be paid to a courteous opening and closing of such a letter.

Questionnaire.—The questionnaire is often a useful, but also a much used and a generally abused, method of collecting research data. A proper and efficient use

of questionnaires can invariably be measured by the number of completed returns. Unfortunately, these are belated tests, and it devolves upon the research worker to observe the principles underlying the effective use of questionnaires in order to assure general and complete responses. The importance of the questionnaire letter must not be underestimated and, therefore, should be carefully composed. In regard to the form, timeliness, and scope of the questionnaire itself, certain rules should be accurately observed:[1]

1. Careful study should be made of the elements in the problem and of the specific data required, in order to assure:
   a. Accurate framing of the questions.
   b. Complete and adequate returns in order to avoid failure of the research or duplication of the questionnaire.
2. The question should be framed to meet the following tests:
   a. Do they consider the point of view of the individual addressed?
   b. Are they clear in meaning, so that only one interpretation is probable or possible?
   c. Is it reasonably likely that they will be answered?
   d. Can they be answered with a minimum effort —permitting checking or underscoring as freely as possible?
   e. Are they an appeal for facts, rather than impressions or opinions, wherever and whenever possible?

[1] An excellent example in the use of the questionnaire method is contained in the *Quarterly Journal of Economics,* Vol. 50, pp. 1-51, by Taussig, F. W., and Barker, W. S., "American Corporations and their Executives: A Statistical Inquiry."

3. The number of questions, or the scope of the data requested, should be judged:
   a. By the conditions in the research problem indicating the extent to which questionnaires must be relied upon for obtaining the necessary data.
   b. By the nature of the questions to be asked and the probable degree of responsiveness reasonably to be expected from the type of the individuals addressed.
   c. By the degree of compromise possible between the conditions as determined by (a) and (b) which may permit a limitation of the questions to a reasonable number.
   d. By the possibility of increasing the number of questionnaires which may be sent out to offset the probable decrease to be expected in the number of returns in case the questionnaire cannot be shortened to a desirable length.

Other aspects of a good questionnaire are:

4. The questions should be developed in a logical sequence in order to:
   a. Stimulate interest.
   b. Facilitate answers.
5. The questions should be selected in such a way that as much data as possible may be obtained by a comparison of answers or may be derived from the actual data obtained.
6. The actual sending of questionnaires should be accurately timed to reach their destinations at a time when favorable replies may be expected, for example, avoid vacation periods, periods when re-

ports are made, the close or the beginning of the year. So far as possible, select periods when data or information may be fresh in mind, or when interest in a subject is rife.

After a questionnaire has been carefully prepared with deference to the above principles, it is often desirable to test it by submitting it to a number of individuals selected as typical of the class of persons to which it is to be sent. Finally, the typographical form of the questionnaire is important. There are six ways of transcribing: (1) manual typewriting, (2) mechanical (electrical) typewriting ("Hoovenized"), (3) multigraphing, (4) mimeographing, (5) hectographing, and (6) printing. If only a few are required, or the research worker has the means, manual typing may be desirable; while, if a great number are to be employed, it might be well to consider printing, or, if only a moderate number, then (2), (3), (4), or (5).

Indirect methods of obtaining data from primary sources.—Should the research worker be in a position to delegate to hired subordinates or assistants the work of collecting the data, the question of how much discretion should be left to them is a matter of importance. Whatever supervision seems desirable, the principles which have been discussed should be carefully observed, in order to assure complete and reliable results. From the employment of assistants it is but a step to the utilization of data collected by research agencies such as have been previously discussed. In this connection, the researcher must make certain that the data are reliable by checking up the methods and procedure employed in their collection and publication.

Procedure in collecting secondary data.—Whenever

secondary data are to be used, the methods of developing a bibliography of the secondary sources are substantially the same as those outlined under Step III. Many leads suggesting these sources may have been obtained already from the references and in their perusal, during the preliminary survey of the field of research. It is necessary at this point merely to extend and make more intensive the inquiry into bibliographical sources.

References.

Chaddock, R. E., "Principles and Methods of Statistics,"
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Ch. VII—The Collection of Material.
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Ch. XVI—Some General Principles of Investigation, Observation, and Experiment.

Chapter XII

STEP XI—SYSTEMATIZING AND ARRANGING THE DATA PREPARATORY TO THEIR ANALYSIS

Preliminary considerations.—Research data as they are obtained from various sources and by different means present a raw mass of information. Before this basic and original information can be analyzed and interpreted the data must be sifted and methodically arranged—a procedure which requires the editing, sorting, classification, and setting up or tabulation of the data and their reduction to an orderly whole. Before discussing ways and means of conducting this phase of research, let us briefly summarize our study of the form in which data are, as a rule, procured:

Sources and Methods Employed	*Form in Which Data Are Received*
1. Primary sources—direct method:	
a. Personal observation	Cards containing rough classification of data. Original notes of observations. Write-ups of observations.
b. Personal interview	Original notes of interviews. Write-ups of results immediately after interview. Materials, records, or reports obtained.
c. Correspondence:	
(1) Letters	File of replies received. Materials, records, or reports obtained.

Sources and Methods Employed	*Form in Which Data Are Received*
(2) Questionnaires	File of returns. Materials, records, or reports obtained.
2. Primary sources—indirect method:	
a. Assistants, or hired investigators	Similar forms of data as under 1.
b. Utilization of data collected by others or by fact-finding bodies	Tabulations. Graphs and charts. Published reports. Documents. Averages, and so forth. Raw data.
3. Secondary sources: a. Bibliographical references, and material collected for similar or other purposes	Tabulations. Graphs and charts. Averages, and so forth. Printed material. Documents. Reports, etc.

Editing the raw data.—The data procured from the primary sources, directly, as in 1, or indirectly, as in 2a above, must first be edited in order to ascertain the degree of their homogeneity, accuracy, and completeness. Data obtained from secondary sources, or indirectly from primary sources, as by means of 2b above, must be checked in order to determine their relation to the primary sources, that is, knowledge must be gained of the conditions surrounding their collection, of the methods employed in collecting them, and of the revisions and changes to which they have been subjected. The object of this is to test the reliability of these data.

Points in editing.—The actual work of editing the raw data, obtained by means of observations, interviews, and correspondence, must cover the following points: Observational data must be checked (1) to eliminate data obtained under unusual or abnormal conditions,

(2) to discover any inaccuracies or inconsistencies which may have crept into the data collected, and (3) to determine whether the data is of sufficient quantity to cover the evidence called for in the problem. Data collected from interviews must be edited for the purpose of (1) discovering obvious misstatements, exaggerations, misinterpretations of questions asked, and other seemingly unreasonable or ambiguous replies; (2) determining inconsistencies and contradictory statements; and (3) judging the extent to which the residual data covers the various angles of the problem requiring the interviews, and of determining the necessity for return interviews. Replies to letters should be subjected to the same sort of editing as is used in checking observational and interview data.

Critical study of the returned questionnaires is a matter of great importance. Each questionnaire should be gone over in detail with the following purposes in mind: (1) to determine the number and the kind of questions for which answers were received; (2) to check the individual answers with the nature of the data called for by the questions; and (3) to note inaccuracies or inconsistencies in the replies made. Unless uniform meanings have been inferred from the questions, unless seemingly correct answers have been given, and unless a sufficient number of questionnaires have been completely answered, there could be no basis for comparison of the data and, therefore, no mass treatment of them would be warranted.

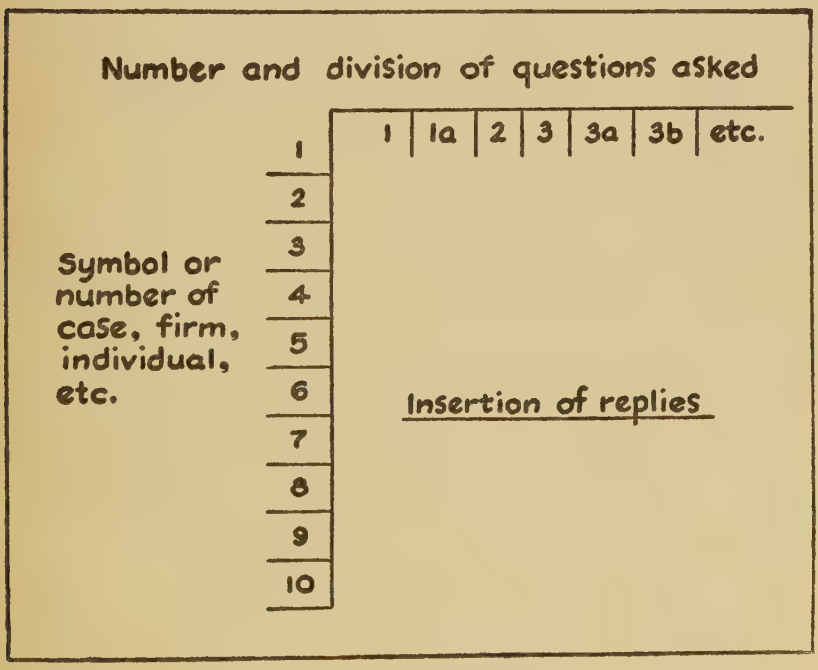
Checking the edited data with the data required.—After all the raw data at hand have been carefully sifted by punctilious editing of the returns and by critical examination of the data procured from secondary sources, the net results of such painstaking procedure should be checked with the elements in the out-

line of the problem to which they pertain, in order to ascertain whether they are of sufficient completeness to carry the research to a successful conclusion. If gaps appear in the mass of data acquired, further steps must be taken, naturally, to obtain the missing information. If primary sources have been unfruitful and if further appeal to these seem in vain, then reliable secondary sources might have to be found. In like manner, if the secondary data obtained seem unreliable, then a direct appeal to their primary sources must be made. If these alternatives are found to be impossible, the research problem may have to be modified or abandoned.

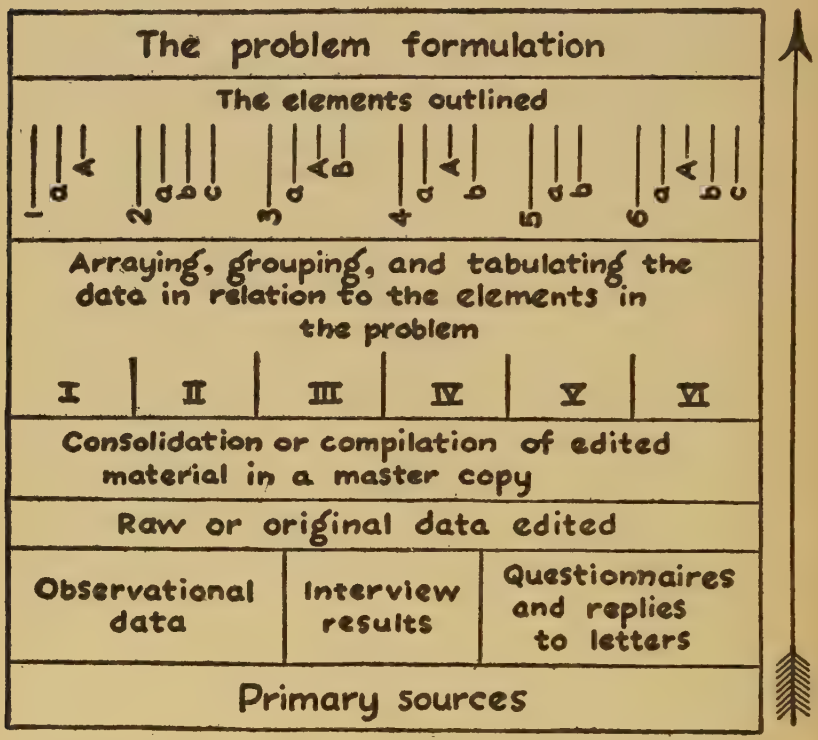
Systematizing and arranging the data.—Assuming that the data obtained are judged to be complete and satisfactory, the next logical step is their methodical arrangement. This means that the raw or basic data must be organized, or combined into such forms of classifications as their nature and intended use may require. In this task, the outline of the elements in the problem must serve as a convenient and necessary guide. The researcher has previously registered the data or evidence required opposite the various elements in the problem. The preliminary systematizing, compiling, or tabulating of data is a tentative grouping and arraying of data in convenient form according to the requirements of the separate and related elements in the problem. It is chiefly a question of linking the data or bases of evidence to the specific elements to which they relate. No definite rule can be laid down by which this procedure may be conducted, for it rests solely upon the nature of the data, the nature of the problem, and the judgment of the researcher.

Master copies of edited data.—A few examples and explanations of particular aspects of the procedure nec-

essary may be of value at this point. The checked returns from observations, interviews, or questionnaires are very likely to contain separate or definite categories of data relating to different parts of the research problem. If these are clearly recognized they may suggest a basis for systematizing the data. If possible, a master copy in which all the data are combined and grouped should precede the task of dividing them into separate compilations. This master copy will serve as a convenient and effective scheme for keeping all the collected data before the eyes of the researcher. For example, a master copy of the returns from questionnaires may serve as an illustration for a similar treatment of data obtained by observation and interviews, and as a convenient recapitulation of the data. A simple scheme for such a master copy is as follows:



Such forms or devices forestall unnecessary fumbling with an unmanageable number of cards, replies, or questionnaires and also avoid the resulting turmoil and confusion. The whole idea underlying this preliminary handling of raw data may be graphically depicted as follows:



Selecting the basis for compilations.—The basis for arraying, grouping, and tabulating the data, as previously emphasized, must be secured by a critical survey of the individual and related elements in the outline upon which the data should be segregated and classified. The data in their relation to the research problem may permit of a variety of groupings and regroupings,

in order to bring out the different relationships within the data themselves and between these and the various elements in the problem. "Grouping," "compiling," and "tabulating" are similar expressions referring to the handling of the data by means of classification. The bases for such classifications are obtained partly from the nature of the data and partly from the nature of the evidence they are to reveal. The latter was, to some extent, perceived in determining the relation of the data to the elements in the problem. The significance of the actual relationship between the data and the elements is a matter to be suggested or inferred in the succeeding step relating to analysis and interpretation of the data or evidence. It is highly important that the research worker understand the nature of this important phase of research methods, for all handling of the data should be predicated upon a definite and clear understanding of the reasons therefor. If these are not clearly recognized, the desultory manipulation of the data which results cannot arrive anywhere.

Points in editing secondary data.—Let us now pass on to the editing and arranging of secondary data. In the first place, these data are often collected and published for a purpose quite different from the use to which the researcher intends to put them. In the second place, the form in which they appear is conditioned by the purposes they were to serve. The editing of these data should have as its aim: (1) to determine the purposes for which they were collected; (2) to check the number of the republications through which they have gone in order to ascertain the number of changes or revisions to be noted; (3) to discover, if possible, the sources from which they were obtained; and (4) to understand the form in which they are presented.

Rearranging secondary data.—Having arrived at the important information concerning the nature of these secondary data, which such editing reveals, the question of using them for the purposes at hand involves the decision as to whether they may be used in the form in which they were found, or whether they must be dissembled and recombined before they can serve as a basis for the evidence required.

If, after careful study, the researcher concludes that the form in which they have been procured seems adapted to the problem, their use has been greatly simplified. Should it be found necessary to decompose and reanalyze them as a preliminary to recasting them along the lines that will meet the conditions of the particular research problem, the researcher must guard himself against difficulties which may lead to the making of dangerous errors. These difficulties may arise from a lack of sufficient information on the basis for the original classification, or on the original nature of data as compiled or tabulated. Access to the original or basic data being, as a rule, impossible, gross errors may creep in when the research worker attempts to guess at, or assumes certain things in, their recompilation. Careful scrutiny should be made of the explanatory notes or materials that accompany these data, as well as of such probable explanations as may have accompanied them in an earlier presentation or publication.

The procedure of discovering the best way of setting up the data, and of the actual setting up, as outlined in this step, provides the necessary basis for the subsequent task of analyzing and interpreting them. Although in the actual practice of research it may not always be possible, let alone desirable, to make a clear demarcation between certain phases of this and of the next step, yet

the necessity for systematizing and arranging data as a preparation for their detailed analysis and interpretation must be self-evident.

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Ch. XLV—Mechanical Aids in Statistical Work.

Chapter XIII

STEP XII—ANALYZING AND INTERPRETING THE DATA

Preparations for the step.—As we have seen, the work preparatory to this step consisted of editing, sifting, and arranging the data in an orderly relation to the elements in the research problem. Such grouping and arraying of the carefully checked data by means of classification and tabulation lead to an effective orientation of the data to the problem at hand, so that the inchoate mass of data was systematically marshaled into such form that they could be intelligently approached for analysis and interpretation.

Twofold method and procedure.—The method and procedure in analyzing and interpreting the data involves (1) the objective material in possession of the researcher—the partially organized data still requiring perhaps some manipulation and conversion; and (2) the subjective reaction to that material, the desire to wring from the data the inherent meaning in their relation to the problem.

Nature of subjective processes.—This analysis and interpretation is a process of thinking in the presence of facts. Thinking begins with the recognition of a problem or difficulty. The difficulty here lies in discerning the inferences or evidence to which the research data may point. Recognition of the fact that such latent

meanings exist leads to the effort to perceive the vague outlines of these meanings. Intensive observations of data and the relationships between them afford more definite suggestions of meanings, inferences, or evidence, resulting in a kind of anticipation or forecasting, which, in turn, leads to the framing of ideas. The mental function of framing ideas from suggested meanings is known as "thought." After specific ideas have been framed, in the fashion just described, the association of related ideas leads to the building of conceptions. Conceptions must be given definition and then follow the processes of abstractions and generalizations.[1]

Thinking in relation to research.—In terms of the methodology of research all of this means that the sifted and organized data must be analyzed and interpreted in their separate, as well as in their related, parts. The individual data, and the relationships of various individual data, must serve as the basis of thinking, in order to apprehend the meanings, inferences, or evidence which they suggest. Combining the separate meanings or evidences inferred into logical reconstructions, and bringing these reconstructions into logical relationship to form more general ideas according to the evidence in the data, leads, step by step, to the solution of the problem or to the objectives of the research, which can be stated in terms of abstractions and generalizations.

Recasting of data often required.—This general description of the processes of thinking required in analyzing and interpreting research data can often be greatly facilitated and rendered more effective if the data

[1] In this connection the researcher is referred to John Dewey's invaluable work, "How We Think," Part II, for a complete analysis of the process of thinking.

which serve as the necessary basis for thinking may be subjected to constant manipulation and recasting. Naturally, such continual reshuffling causes the data to be suggestive of further possible meanings or inferences. The technique in the rearrangement of data, therefore, is to be regarded as a valuable and important aid in obtaining correct evidence; meanings will be more freely suggested, and ideas can be framed and tested more readily if various methods of diagnosing the data are applied.

Methods of analyzing data.—Although we have suggested that the desirability of recasting and converting or reconverting the data may be considered primarily as an objective matter, nevertheless, the procedure closely interacts with the subjective processes of analysis and interpretation. A detailed explanation and description of this important phase of research would cover far more space than we can allot to it. In the first place, the nature of the data compiled for research purposes is exceedingly variable; and, in the second place, the means by which the latent meaning inherent in widely different data may be made more accessible, or the inferences facilitated, vary in their applicability according to the particular nature of the data. It would be too much to assume that all data should be manipulated or recast by certain prescribed methods in order to aid their analysis and interpretation. Nevertheless, certain suggestions may be of value to the research worker as creating an effective point of view in reference to this important aspect of research methods:

1. It is necessary to recall that the data have been developed in the preceding step according to the rules there suggested. Much of the data may be

cast in such various forms of classifications, compilations, and tabulations as were required to render them coherent and convenient. These classifications required a basis, or bases, obtained from the nature of those particular elements in the problem to which the data were related, and, in this connection, necessity for some interpretation was encountered. Whatever tabulations were undertaken had to do largely with combining or consolidating the raw mass into some such scheme as the master copy. Frequently, it might have been found that certain data required more complete tabulations based on the units in which the data were expressed and arranged according to one or more other measures or relations, such as periods of time, class, size, value, and so forth. In any event, such tabulations might not readily reveal the nature of the evidence in the data.

2. Confronted with the data in these various forms, the research worker may find it desirable or necessary to recast them further in order to derive suggestions for inferences. If so, the following methods may be employed:
   a. Tabulations and retabulations, with the aim of further differentiating the data and relating different portions of them to each other. Such tabulations might reveal new or more complete meanings, or might corroborate tentative inferences previously drawn.
   b. Averages, in the various forms, namely, mode, medians, quartiles, deciles, and so forth—arithmetical, geometrical and harmonic—may be used to obtain quantitative criteria of mass data. It is often the case that only by aver-

ages can the complete meaning of mass data be ascertained or comprehended. The use of different averages more nearly may reveal the correct meaning, especially if they take into account certain qualitative differences assumed by the units in the mass data.

c. Weighing of various particular data combined or grouped with similar data for purposes of summary. This will often lead to more accurate inferences concerning the evidence certain data may contain.

d. Index numbers, absolute or relative, closely related to averages. These are often employed to represent data in order to suggest trends or comparisons over a period, although not necessarily so.

e. Graphing and charting of data. These permit an indefinite number and variety of ways of handling data to facilitate their analysis and interpretation.

f. Refining data in a statistical form by eliminating the influence of certain factors, such as those commonly referred to as "secular trend" and "cyclical" or "seasonal fluctuations." This will often lead to clearer evidence of certain elements in the problem.

g. Correlating by means of simple mechanical devices, such as tables, graphs, and so forth, and by means of various complicated mathematical formulae, already authorized, or developed for the purpose. These formulae will many times reveal intricate relationships between data.

Necessity of skill in handling data.—Simple data, as well as those that do not yield readily to such methods of analysis, may also require careful reshuffling or reworking in order to exhaust the various points of view from which these data may be studied. No possibility of manipulation should be overlooked which may lead to suggestions of meanings and ideas, or to the accurate testing of different hypotheses. It should be clear to the research worker that the purpose of this step is to discover and to apply such effective methods of analyzing the data as will extract meanings from them. Dexterity in the use of these methods is of enormous importance in research study, and considerable time and effort, as well as imagination, is often required to acquire proficiency. The thoroughness with which research data have been analyzed and interpreted can easily be judged by the skill employed in the technique of manipulating or recasting data in those forms which make them most meaningful. One could establish, indeed, an arbitrary measure of skill in the degree of completeness with which meanings, inferences, or evidence have been derived from manipulated data. Many published pieces of research indicate to a trained analyst that often no more than from 10 to 20 per cent of the inherent evidence in the data used has been discovered. The inevitable result is that the conclusions, supported only by this partial evidence, seem stilted, unconvincing, or forced. Much research effort is often wasted, because the research worker does not know what to do with the data he has collected.

Thinking in the presence of facts.—This phase of research method calls for a prodigious effort to think in the presence of facts; but it is equally important to think about the ways and means of handling those facts.

No degree of mental acumen will serve infallibly to penetrate the obduracy of unsifted or unanalyzed data, whereas methodical analysis of the data will bring out suggestions of their meaning to serve as the basis of inferences and so of evidence. As described before, these inferences lead to the framing of ideas; ideas are related in conceptions, and conceptions lead to definitions, while these, in turn, are transformed into abstractions and generalizations. This rather rigid statement is offered for purposes of emphasizing the importance to the research worker of becoming aware or conscious of his thought processes during this phase of research, rather than for the purposes of ruling out of research all forms of meditative reflections. Reflective thinking, day-dreaming, reverie, a priori processes known as deductions, or forming of hypotheses—all of which are often described "as using the imagination"—have a useful place in research, and without them research work would lack the vital quality of original ideas. But these mental functions should be harnessed to the problem and data and should be made amenable to the exigencies of data-manipulation and data-analysis and interpretation. Without such constant checks or tests, the "use of the imagination" may become so hopelessly detached from the problem and the data that it may lead to self-delusion, or to "fiction building."

Deduction necessary.—The real relation of these deductive processes to the intricacies of research methodology is one of interplay with the inductive processes so formally described on page 6. As we have seen, although data may suggest their meaning, the mind also anticipates or forecasts such meaning, and may even frame ideas concerning them in the form of

hypotheses, for which it then seeks verification or evidence in the data.

Developing conclusions.—It may be assumed, after analysis and interpretation of the data has revealed the evidence they bear, and when this evidence has led to ideas and conceptions relating to the data in detail, and to the more elementary and homogeneous elements in the problem, that the deductive processes begin to be more apparent. The relationship between the individual major elements in the problem, fortified now by a broader basis of data, inferences, and evidence, may be discovered either by induction or deduction. But deduction serves strongly "to define, delimit, purify and set in order" these wider and more general ideas and conceptions obtained by relating the more detailed inferences. Upon these the mental function of deduction develops the abstractions and generalizations without which research methods could not arrive at final conclusions or at their objectives. However, the deductive processes cannot play a lone hand in these later phases of research endeavor, for, now and then, it will become obvious to the research worker that he must have recourse again to the data or evidence from which the meanings, inferences, and ideas were earlier derived to test or verify the final conclusions, or the abstractions and generalizations into which they were molded by deduction. Should the research results have an immediate practical application, they should then be actually tested by the research worker in order to ascertain their practical validity.

In conclusion, it must be emphasized that the discussion of research methods relating to the procedure of analyzing and interpreting data must, of necessity, be limited to the general technique required in handling

the data and to the general nature of the thought processes involved. A more detailed treatment would be possible only if an actual research problem were completely presented; but even then the nature of the thinking processes could not be described fully, or, if they were so described, might not allow for the individual differences in mental thought processes, and so might carry this treatment of the technique of manipulating data for analysis far afield from its intended course and into a discussion of statistical methods.

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Chapter XIV

STEP XIII—ARRANGING THE DATA FOR PRESENTATION

Objects to be achieved in the presentation.—Up to this point research work has been considered chiefly from the point of view of the relation of the researcher to his problem and data, although, in connection with the gathering of data from primary sources, it became advisable for the research worker to take into account the reactions and points of view of others. Now, however, in arranging the data for presentation, the recognition and understanding of the psychology of others becomes a matter of great importance. In presenting the data and evidence in order to appeal to, or interest others, we may recognize two steps: (1) the employing of such means and devices as will captivate the interest of probable readers; and (2) the presentation of proof or evidence adequate and complete enough to make manifest the inferences or conclusions derived from the analysis and interpretation of the data. Toward these ends the researcher may ask himself: (1) "How can the reader be interested and have made manifest to him at the same time the meanings or evidence drawn from the data?" (2) "How may the reader be interested and have made manifest to him the nature of the evidence and at the same time render a complete picture of the data used?" The answers to these questions will reveal the nature of Step XIII.

Basis for the presentation.—The researcher's problem then is: (1) *What* data are to be presented? and (2) *How* are they to be presented? The former requires a careful scrutiny of the original or basic data, these data sifted and systematized preparatory to their analysis, and of the final forms into which they were recast concurrently with their analysis and interpretation. The data then are at hand as they appeared in their three successive stages of completeness, namely:

1. Original or raw data.
2. Edited, grouped, classified, and some tabulated data, preparatory to their analysis and interpretation.
3. Data reconverted or recast concurrently with the attempt to obtain accurate and complete evidence.

What data to present.—The presentation of the data in their original form may appear too cumbersome a proceeding or may demand more effort and time than the average reader cares to give for the purpose of understanding them, and to that extent they will fail to arouse interest or make manifest the evidence derived by the research worker. Yet, under special circumstances, it might seem necessary or desirable to present some or all of the data in their original forms in order to clarify certain methods of analysis employed or to show how the inferences were drawn. Often, instead of presenting the raw data, it may suffice to furnish only the forms or plans used to obtain the primary data, and some illustrations of certain aspects of the methods employed in collecting them or in developing them for analysis. These may often be sufficient to make clear how the evidence was derived. On the other hand,

however, much or all of the original data might well be presented, provided,

1. The research problem is of first rate importance.
2. A very new or comparatively unknown field has been treated.
3. A novel or complex method or procedure has been employed.
4. The probable readers are critical or need to be fully informed.

No definite rule can be invoked, and the research worker is called upon to judge the particular circumstances with which he must deal in order to reach a satisfactory decision in regard to the amount of original data he may find desirable to include. It is to be emphasized, also, that what has been said refers chiefly to data obtained from primary sources, although the further consideration remains of making such data available to the readers by offering them in an appendix or in some other supplementary form. This will be discussed in a later chapter. Finally, the research worker must recognize that the question of what raw data, or matters pertaining to them, may be presented, cannot well be considered apart from the form which the data themselves assumed during their analysis and interpretation.

Form of presentation.—In most research work the form in which data are to be presented should correspond as nearly as possible with the form in which they were recast during the application of the methods and procedure in Step XII. As shown there, the data were to be subjected to certain forms of manipulation for the purpose of deriving meanings, or of testing hypotheses or deductions. The forms evolved in connection with this step in methodology should be revealed to the

reader, for they indicate the final bases of meanings, inferences, or evidence that were arrived at. These logical developments should be made manifest, for they afford the proper groundwork for reconciling the points of view of researcher and reader.

The research worker may present a fair question at this juncture. May not the presentation of the data in the forms predicated upon Step XII be illogical, since it would take the reader backward through the chain of evidence, and would not the reader be more effectually interested and have the evidence made more manifest to him, if he were taken through the same sequence as followed by the research worker in developing the data from its original or basic form to the final forms which they assumed following their analysis and interpretation? This question is pertinent and timely, for all data may not be presentable in the refined form in which they have been finally cast. Such presentation might do violence to interest and understanding.

Which of the two methods of presentation is desirable depends upon the nature of the data and is conditional upon the amount of explanation afforded by the text. Should the research problem and data seem comparatively simple as regards subject matter, methods, and procedure employed, then the presentation of the data might well be satisfactory in the form in which they were finally developed. Of course, necessary explanations of how they were obtained, sources used, circumstances attending their collection, and the type of changes or manipulation to which they were subjected should be made, to appease the critical, or to inform the unwary, reader. On the other hand, should the research problem and data contain difficult and complex questions concerning the several phases of proce-

dure or methodology employed, then it might be not only necessary but also desirable to present the data, or illustrative and explanatory forms, in a sequence similar to that followed by the researcher. This is not intended to imply that all the raw data and their subsequent forms need be presented, but that the presentation may begin with a statement of the reasons for choosing certain sources, the conditions under which they were obtained, specimens of questions and questionnaires, then, perhaps, specimens of the compiled results, such as indicated by the use of master copies, followed by necessary explanations as to how data were edited, classified, tabulated, and even recast, during their analysis and interpretation. Whenever the research work presents difficult or complex problems connected with the procuring, sifting, and handling of data, it is often necessary to strain the readers' interest for the sake of making clear how the data were obtained and employed.

Rules for presentation.—In the matter of presenting the data, research workers will find that their problems veer from the simple to the complex, for the question of what to present, as we have seen, depends on the inherent nature of the data and evidence used in the work. Certain guiding principles may be of service to the researcher in acquiring a point of view from which the task of presenting data may proceed satisfactorily:

1. Data should be presented in such forms as will interest the reader, as well as make manifest the evidence derived by the research worker.
2. The several successive stages through which the data have developed should be reviewed to decide what data are necessary or desirable to present.

3. Data which were obtained by fairly simple means and which required no great amount of complex treatment might be presented in the shape finally developed by their analysis and interpretation, accompanied, to be sure, by such explanations as seem necessary.
4. Complex data, or data acquired under different conditions and by involved methods, and which required considerable refinement and recasting in their analysis and interpretation, should be presented:
   a. Completely, from their raw stage to their final forms, with the raw or undeveloped forms placed either in the body of the text or in the appendix.
   b. Partially in their raw form by illustrative or explanatory sections or specimens, accompanied by the final recast forms.
   c. In final form, as developed by their analysis and interpretation, with sufficient explanation of such relevant aspects as will make them meaningful.
5. In all forms of presentation, the arrangement of the data should make the evidence manifest, and if the data are not sufficiently flexible for such a clear arrangement, then they should be accompanied by explanations, in the form of notes or in the text of the discussion.

General forms in use.—Now the actual forms in which the presentation of the data might be made are innumerable. In general they fall into the following classification:

1. Tables.
2. Graphs and charts.
3. Areas.
4. Textual.

Which of these forms is adaptable to the data at hand, considering the fact that they have probably already undergone a recasting into certain definite arrangements (as illustrated in Steps XI and XII), must be decided primarily in the light of the principles stated in the beginning of this chapter. Just as the data transformed in the procedure of Step XI might have rendered them available, intact, for Step XII, the forms in which the data may be presented by this step might already have been determined and worked out in Step XII. The research worker should, of course, be aware that certain modifications in these forms must often be made.

Tables.—The use of tables or the tabular method is highly flexible and affords considerable latitude in clearly arranging the data for the sake of making the evidence manifest. Classifications and subclassifications horizontally and vertically are possible in table construction and are an aid in making manifest the evidence to which the data point. Care should be exercised to avoid making tables too complex, and this may be accomplished by the use of more than one table and then combining the results in subsequent tables in order to bring out the desired relationships.

Graphs and charts.—Graphic presentation may be employed independently or in conjunction with tables of the data charted. This method includes the use of lines, bars, curves, and so forth. Possibilities in the use

of graphs and charts are numerous and variable. Their great value lies in their appeal to the visual sense and in the high degree of clarity with which relationships may be brought out.

Areas.—The discussion of areas might have been included under that of graphs and charts, but their use as aids in presentation is somewhat different. By areas we mean the presentation of data in the form of squares, cubes, figures, pictures, circles, or other methods of diagramming. The purpose is to present the material as ideas of relative size or comparisons, appealing to the eye by means of some familiar or obvious figure.

The text of discussion.—The textual method, as a form of presenting data, is often sorely abused. A running account of data or facts in the body of a research treatise should be avoided as much as possible, unless the data so presented are comparatively simple and easily understood, or unless the data are so closely blended with the discussion of the evidence that they cannot well be set apart from it. It is true that evidence must be discussed in the body of any treatise, even though tables, graphs, and so forth, have been presented; but the textual method refers primarily to the presentation of data without the use of any of the other three forms in which data may be presented. The use of the textual method, except under the conditions above referred to, wearies the reader and invariably destroys the effectiveness of the presentation.

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Chapter XV

STEP XIV—SELECTING AND USING CITATIONS, REFERENCES, AND FOOTNOTES IN RESEARCH

Their proper use.—Citations, references, and footnotes are often regarded as indications of erudition, or as criteria of thorough scientific analyses, whereas they have been so misused and so much overdone that they have come to be regarded in certain quarters with a good deal of derision. Of course, those who ridicule the use of them are as much in error as those who treat them as infallible evidences of work well done. The dilemma, naturally, arises from the lack of purpose which is so often characteristic of their use. There are actually very potent reasons why citations, references, and footnotes may greatly improve the quality of a research treatise, and it is, therefore, important to understand the purposes they are to serve.

Materials from which derived.—The materials from which citations may be taken, or to which references may be made, should be found in the bibliographical studies pursued under Step III, and, in addition, in such statements and printed matter as were obtained in collecting the data, as explained in Step X. The file of cards containing the bibliography, the notes taken during the study and perusal of the literature and during the conduct of interviews, the gleanings from letters and questionnaires, in fact, all statements, written or oral,

that seem significant as bearing on any phase of the research problem, if noted and filed, should furnish fertile sources for citations and references and a rich and adequate background for the presentation of the research results.

Central points of usage.—Any discussion of the selection and use of citations, references, and footnotes must revolve around three points, namely, (1) the meaning of citations, references, and footnotes; (2) the purpose underlying their use; and (3) the form they should take—the mechanics of their use. The research worker must grasp the idea that they are means by which the problem can be developed more fully, by which the presentation can be better organized, and the whole research product orientated in the field of research with respect to allied studies in the same field. It cannot be overemphasized that the use of citations, references, and footnotes should be an integral part of the development, organization, and presentation of the research report. They are not things apart but means by which a work can be better done.

Use of citations.—Citations are quotations or excerpts of material from another author, or from another person's spoken words. These are not taken and used indiscriminately, promiscuously, or at random by a careful research worker, but rather they are well chosen and incorporated at particular places for a definite and significant purpose. In good usage, citations are employed for one or more of the following reasons:

1. To secure effective expression. An idea or thought may have been expressed by some one else in words most aptly chosen, or in terms singularly descriptive.

2. To support or corroborate the researcher's own point of view with reference to (*a*) the data and evidence obtained, (*b*) the inferences drawn or ideas tested, (*c*) the methods of analysis and interpretation of the data, or (*d*) the steps leading to the conclusions. Other authors or persons may be quoted in this connection who possess the necessary qualifications of experience or study.
3. To show not only concurrence, but also non-concurrence, or neutrality in the opinions, conclusions, or ideas of others as relating to particular aspects of method or subject matter covered by the research problem. The object here might be to disprove or disagree with, or to reconcile, clarify, and so forth, the ideas of others.
4. To retain the originality of the matter quoted, especially in regard to such materials as laws, regulations, official rulings, and so forth. It is invariably essential to state the exact words or forms of such matter, rather than a digest or a garbled account.
5. To present certain research data or information used as evidence in the exact form in which they were obtained from the sources. This may be for the purpose of avoiding misunderstanding, or to make the reader aware of the actual data from which evidence was derived.

Form of citations.—The citation may appear either in the body of the research report or in a footnote, depending on its importance or relevancy to the matter or purpose at hand. In any event, citations should be clearly marked or indicated. Indentation, single spacing, smaller type than that used in the body, each and all

may be used. Quotation marks might be employed, although they are not absolutely necessary. Care should be taken to cite accurately and faithfully, which means that if some parts are elided, they should be indicated by the phrase "and so forth," or by ellipses (. . . .). Quotations within quotations should be set off by single quotation marks. The source of the citation should be accurately and clearly stated either just before or just after the citation or in a footnote. But at this point we encroach upon the use of references.

Use of references.—A reference is the directing of the attention to the written or spoken words of another and to the exact place, in the case of printed materials, or in the case of spoken language, to the circumstances under which, or the place where, such statements occurred. References may be made to the source of material given in citations, or to that of materials or statements alluded to or suggested by the research author. They may even refer to other parts in the research study itself. That is, there may be both "external" and "internal" references. As in the case of citations, the materials or statements referred to should be regarded as leaven in the research study and its presentation. They should be carefully and critically examined, in order to determine whether they are relevant or cognitive. The purposes for which references may be used in research study are as follows:

1. To refer to additional or other treatment of points discussed, or to additional or other methods employed. The aim may be to avoid unnecessary incorporation of the discussion of an idea or a method, or of the citation of the material which was developed by another.

2. To avoid repetition of the presentation of the points of view of others in the research study. Throughout the development of the discussion, it might be necessary to call the reader's attention to materials and statements of others already referred to elsewhere in the text.
3. To show differences or similarities between the research study and other treatments of the problem. Such comparisons are often necessary and desirable in order to make manifest the position of the author in relation to the views of others. The aim may also be to seek corroboration or support of the method and conclusions of the researcher.
4. To make clear the relation of the discussion to the data or evidence used in the research. The object may be to render forceful or emphatic the ideas presented or show the relation of the ideas, conceptions, definitions, abstractions, and generalizations to the data.
5. To suggest or give the sources of data used in the text and in the tables, graphs, and so forth.
6. To serve the researcher, as well as the reader, a means of connecting or relating the different parts of the text, or the various data presented, or the discussion and data presented elsewhere in the treatise. This implies the use of cross references.

Form of references.—References may appear either in the body of the text or in the footnotes, depending to some extent upon the predilection of the author; but, in the final analysis, upon the significance and importance of the meanings or suggestions they are intended to convey. In whichever place they may appear, the

form of references is fairly well standardized. The material referred to should designate the name of the author, the title and edition of the book, the chapter and pages, or, if an article, the name of the periodical, date of issue, and so forth. If the reference embodies an oral statement, the name of its author, where and when it was made, and under what circumstances it was made. Choice may be exercised in italicizing either the author's name or the source, namely, the title of book or periodical, the title of the chapter, if used, or that of the article, is not often put in italics. Emphasis on the source is often desirable, and therefore it should be italicized rather than the name of the author.

References concerned with the sources of data used, or with the relation of data to the discussion, vary greatly in the manner of their indication. In regard to secondary sources and data, the methods are similar to those just outlined. If references are made to primary sources of data, the sources should be stated first and emphasized by means of italics, followed by such necessary explanations as seem pertinent. Other matters of technique connected with the use of references are better discussed under the following:

Use of footnotes.—Footnotes are means of furthering the end of citations and references, and, in addition, may perform independent services. As a rule they are placed at the bottom of the page containing the matter to which they relate, and, if long, may be continued on subsequent pages. Recently, some authors have relegated them to the final pages of the treatise in the form of notes. This is only justifiable provided the material contained in the notes is not an integral part of the development and presentation of the research study.

The purposes of footnotes are:

1. To contain the references and sources of citations.
2. To contain supplementary data, explanations, or discussions, desirable or necessary, which appertain to ideas or data presented in the body of the treatise.
3. To contain citations not considered important enough to be included in the main text.

Index signs in footnotes.—If footnotes are to contain the references to, or sources of, citations, the relation between the point in the text where the reference is suggested, or the citation made, and the reference or source presented in the footnote must be established. For this purpose, corresponding figures or indexing signs, such as asterisks (*), daggers (†), double daggers (‡), section marks (§), and so forth, should be employed. If figures are used, they may run consecutively for a page, for a chapter, or for the entire treatise. Because of the limited number of signs extant, it is preferable to use figures, reserving the signs for use in connection with tables presenting the data, if these data need indication or explanation. Since tables deal largely with figures, confusion may thus be avoided.

Much the same conditions hold true if footnotes are to present supplementary data or discussions and citations. These data or discussions and citations should be carefully linked with the particular points in the body of the treatise to which they are related by means of indexing figures.

Cross references in footnotes.—In case references are to be made to other references or citations in the treatise, or to other parts of the treatise itself, whether

contained in the body or in the footnotes, there are certain abbreviations of terms which have attained general usage. These references are called cross references. For example, there are such abbreviations as these:

Ibid., meaning the same. Used when reference is made again to the same source or material without any intervening references to other sources.

Cf. supra, or ante, refers to something before.

Cf. infra, or post, refers to something following or after.

Op. cit. means same sources cited above, although other references have intervened.

Passim refers to material running scatteringly throughout a reference made.

Loc. cit. means the place cited and used, if reference is made to a former citation.

Et. seq. used to indicate "and following."

In all cases, where the volume, chapter, page, or pages are to be given, the abbreviations of "Vol.," "Chap.," and "p." or "pp." should be used. Also ¶ indicating the paragraph, § the section, and "Art." the article, should be freely employed.

Care should be exercised that one's fancy does not affect the choice and use of footnotes. They should be used sparingly and with a definite and significant purpose. Great pains should be taken in selecting and weighing the data, discussion, and citations inserted, and the matter of form should be given careful consideration. Citations, references, and footnotes, as has been repeatedly emphasized, are tools by means of which a research treatise may be shaped into a well-rounded form. They serve (1) to orientate the whole study in

relation to similar or other studies in the same or a similar field, and (2) to organize the research treatise into a logically developed whole. They should be considered, then, as integral parts of the development and presentation of the research study.

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Chapter XVI

STEP XV—DEVELOPING THE FORM AND STYLE OF THE RESEARCH EXPOSITION

General form of research exposition.—Broadly considered the separate parts of an exposition which is presented in the form of a report, thesis, or treatise are, in sequence (1) preface, (2) table of contents, (3) introduction, (4) body, (5) conclusions, (6) appendix, if any, (7) bibliography, if any, and (8) index. These forms take on a definite meaning in relation to the exposition of a research study.

Preface and introduction.—It is very difficult to distinguish between preface and introduction. So far as research material is concerned, preface, introduction, and foreword may be considered synonymous. A true research student does not talk at great length about his problem, for he is usually a man who can state matters tersely and still convey the meaning. In this section it is often desirable to state briefly but clearly the scope of the inquiry, the character and general outline of the problem, and the purposes or objectives in the mind of the researcher. If acknowledgments of a general character are to be made for favors or aid received, they should be set forth in this opening section. Special difficulties encountered in the prosecution of the research study, or novel and difficult methods pursued, may be discussed in an introductory way. The table of contents should immediately follow this preliminary dis-

cussion, unless both a preface and an introduction are used, when it should follow the preface.

Table of contents.—The table of contents, as the term implies, is a topical outline of the entire treatise in the order of chapters and pages. The purpose is to give the reader a bird's-eye view of the entire work.

The body of the exposition.—The body contains the heart of the exposition, embracing, as it must, the presentation of the data and the discussion of their analysis and interpretation, as well as the steps leading to the conclusions, and often the conclusions themselves. It is frequently necessary or desirable to emphasize the conclusions in a separate summarization or a restatement. This may be done even though their development has been clearly traced or expounded in the body, but is especially necessary if the conclusions have been developed scatteringly throughout the body, and, therefore, require synthesizing.

Appendices.—Appendices may contain such matter as might have appeared ordinarily in footnotes, but, because of being too voluminous or not sufficiently relevant, at the time, were deferred and indicated in the body of the text or in the footnotes. Furthermore, some data, whether reorganized, additional, or basic and original, may be given in an appendix. Material presented in an appendix should be homogeneous, and if such material so presented deals with or relates to different aspects or parts of the body, it should be segregated in several appendices, which should be designated by capital letters, for example, A, B, C, and so forth. References in the body should then be made to "Appendix A," "B," and so forth.

Bibliography and index.—The bibliography may be classified or unclassified. Classification may be made

on the basis of (1) chapters in the treatise; (2) books, periodicals, circulars, newspapers, and so forth; (3) alphabetical order or names of authors, titles of books, periodicals, and so forth. Naturally, cross classifications on these bases are also possible. Finally, there is the index, which is an alphabetical classification and subclassification of the important and significant items or topics which suggested basic ideas or conceptions discussed and presented throughout the treatise. The number of the page or pages appears opposite the items in each classification and subclassification.

Relation of the outline to the scheme of an exposition or treatise.—The various parts of this scheme provide the mechanical framework which is to be used by the research worker as a skeleton for the presentation of his exposition—a guide for the "offering" of his material. This material consists of his detailed, complete, and highly differentiated outline, together with the mass of data classified and amplified, of inferences and evidences, of objectives, of conclusions, of references, citations, and so forth, which he has gathered in the course of his study. He has, in this mass, the body of the treatise, which, already organized as it must be if he has done his work properly, awaits only some amplification of explanation, and composition of those explanations in the form of paragraphs, chapters, and so forth, in order to assure the appeal of his work from the standpoint of interest and understanding.

Materials as a basis of the exposition.—The scheme of an exposition, then, and the research work which has found its place as the body of the exposition, is the starting point for the student for developing the form and style of the treatise or report. With these in hand, the research worker should proceed to analyze his out-

line closely. In it he will discover the various elements of the problem logically related and organized. These elements suggest the substance of the outline. The results of Steps XII and XIII, moreover, have netted a great deal of this substance, tangible and intangible. Under Step XII, the heart of the research problem was developed by the analysis and interpretation of the research data. The results of the work there undertaken should be available now in the form of notes or other written material, containing the accounts of the analysis and interpretation of the various data. These expositions of the meanings, inferences, evidences, ideas, conceptions, and definition drawn from the data and relating to the various elements in the problem constitute the so-called rough material at hand. Under Step XIII, the data and information have been prepared for presentation and the various forms in which they are to be incorporated in the text are also available. At this point, then, the researcher has passed the third milestone in writing up his research study. These have prepared him for the actual work of composition. First, he has carefully considered the various parts of the general scheme of an exposition. Second, he has studied the outline of the problem. Third, he has collected the various data, usually in the form of tables, graphs, areas, and so forth, and the batch of rough notes or expositions developed while analyzing and interpreting the data, and has arranged these according to their bearing upon the logically organized elements in the problem as outlined.

Nature of actual research exposition.—The exposition now proceeds upon a well-devised plan and with a well-developed perspective. All the essentials are available, including the basic and original data which

should always be kept at hand to serve as ready references when the exposition deals with the presentation of evidence or proofs. At this point, when the actual literary work begins, it is nip and tuck between the researcher's ability to express ideas in writing and the meanings and ideas latent in the material to be presented. The process of presenting a research study involves both analytical and synthetical methods of expression. An exposition aims to expound, unfold, interpret, or explain. In research work the analysis and interpretation of data proceeds in a very detailed manner, as was indicated in the procedure under Step XII. The ideas first framed require exposition, that is, they must be clearly understood by the researcher and should be written up in an expounding or explanatory fashion, so that they are not only accurately expressed but also capable of suggesting or conveying their meaning to others. But single or related ideas and their accurate and intelligible expositions must be combined, put together, arranged in order, or logically coördinated. This is what is called composition.

Organizing and developing the exposition.—In the actual work of writing up a research study, the expositions of the manifold analyses and interpretations of the various separate data or categories of data must be composed, related, or coördinated. The basis for a logical composition is contained in the outline of the research problem, amplification of the detailed relationships between its various parts—among the mass of data and their meanings—and incorporation in the fabric of the composition of the more general relationships suggested by the various phases of the analysis of research data.

Finally, there is the task of orientating the whole ex-

position and composition with regard to the ideas of others, and of organizing and relating the ideas within the research study as explained in the use of citations, references, and cross references.

The question of the quality of words and sentence structure chosen is one of individual peculiarities and of training in forms of expression. These need not detain us here.

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